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THE
LARYNGOSCOPE.

VOL. LIII OCTOBER, 1943. No. 10

LABYRINTH SURGERY FOR MENIERE'S DISEASE.*†

DR. KENNETH M. DAY, Pittsburgh.

There is considerable disagreement as to the meaning of the term "Ménière's Disease." As originally used it referred to a spontaneous hemorrhage into the labyrinth based on a case described by Ménière in 1861. The terms "Ménière's Syndrome" or "Ménière's Symptom Complex" were later used to designate the group of symptoms originally described by Ménière in association with his case but which were found to occur in many other conditions. In recent years the term "Ménière's Disease" has been more loosely applied to include all cases showing the so-called syndrome with negative otoscopic findings. Dandy[2] has used the term of "pseudo-Ménière's" in cases in which only the vestibular part of the labyrinth was involved. It is known that the Ménière's Symptom Complex may occur from a number of causes but little effort seems to have been made to subdivide the cases showing these symptoms. This group of symptoms consists of paroxysmal attacks of labyrinthine vertigo with or without nausea and vomiting, usually associated with severe tinnitus and some degree of deafness. The symptoms may be of toxic origin, and I have personally experienced them from food poisoning. They may be caused by allergens, and a considerable number of cases have been reported with a proven allergic basis. They frequently occur as local manifestations of systemic conditions such as syphilis and cerebral arterio-

*Read at the Forty-eighth Annual Meeting of the American Academy of Ophthalmology and Otolaryngology, Chicago, Oct. 12, 1943.

†From the Department of Otology, University of Pittsburgh School of Medicine.

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sclerosis. The above groups often show a hyperirritable labyrinth. I believe that the term "Ménière's Disease" should be limited to the group of cases which show symptoms and signs of distention or hydrops of the membranous labyrinth of unknown cause, the so-called idiopathic type. This apparently is a disease entity, though its etiology and nature are still unknown. It has been suspected for years that the cause of many of these recurring paroxysmal labyrinthine attacks is an increased intralabyrinthine pressure or glaucoma of the labyrinth. Whether this is due to an increased secretion of endolymph, a decreased resorption, or a chemical imbalance has yet to be proven; but there is a sound basis for each of the three theories. Sufficient autopsy material has now been studied to show that hydrops or distension of the labyrinth does definitely occur, and there are some dozen cases reported to date.[1]

I have been studying this subject for several years and believe I have seen enough clinical cases to enable me to describe the symptoms and signs which should occur in such cases and which I have encountered in the group of cases which I am reporting. They are as follows: Intermittent paroxysmal attacks of vertigo often associated with nausea and vomiting, deafness and tinnitus of varying intensity and frequency, and negative otoscopic findings. In the early stages of the disease it is not uncommon for the vestibular labyrinth or the cochlea to be affected separately but. sooner or later, both parts of the labyrinth become involved. The deafness often varies in severity from time to time and usually involves the entire scale with decreased bone conduction, diplacusis and distortion. Tones are heard at a lower pitch in the affected ear. If the condition continues over a period of years, the deafness becomes more profound and shows little or no variation. The diplacusis and distortion are no longer noticeable because of the severity of the deafness. Audiograms suggest a uniform nerve deafness. Tinnitus is an almost constant accompaniment of the deafness and is usually of a double nature, a high pitched ringing or hissing which is not bothersome, and a low pitched pounding or roaring usually synchronized with the heart beat, which is most troublesome and which in some cases is complained of as bitterly as the vertigo. Caloric tests show either a nonfunctioning or hypoactive labyrinth on the affected side, and the reaction to the

caloric tests may vary at different times. As a general rule, the more severe the deafness the less reaction to the caloric test. A curious finding in many cases is the diminished reaction, especially of the vertical canals, to caloric stimulation of the unaffected labyrinth. This may be due to nature's effort to balance or equalize the activity of the opposing labyrinth. The above symptoms and signs are suggestive of a varying endolymphatic distention with an accompanying variation in the sensitivity of the end-organs involved. Acute attacks may occur in either one of two opposite ways. First, from an increase in pressure in one labyrinth which suppresses its activity and results in a physiologic labyrinthine over-reaction from the opposing labyrinth. Secondly, the reverse might occur and the attack could be due to a temporary release of the pressure in the distended labyrinth so that this labyrinth "kicks in" to upset the balance control of the other. It is significant that during an attack the hearing in the affected ear may markedly improve. Between acute attacks there is usually some deafness, the low pitched tinnitus continues and the offending labyrinth is hypoactive to stimulation. Patients frequently complain, between acute attacks, of a constant sense of imbalance or unsteadiness and of a feeling of pressure or fullness in the head.

No attempt is made here to explain the underlying cause of hydrops of the labyrinth nor is any consideration of the medical treatment attempted, except to point out that most measures advocated at present aim at the relief of distention of the labyrinth: These include the use of histamine, nicotinic acid, sodium elimination or replacement and the use of dehydration therapy. It has been my experience that conservative therapy seldom cures, although it often alleviates the condition and enables the patient to tolerate it. I believe that conservative therapy should always be tried. There are many cases, however, which do not respond to conservative measures, and the condition is so incapacitating that patients become desperate and are willing to undergo any surgical procedure which might cure them. Moreover, many of these patients are unable to work or earn a livelihood, and any protracted medical treatment is out of the question for economic reasons.

The accepted surgical procedure at present is section of the vestibular nerve[2] and has been quite successful in a few

expert hands; however, it is a hazardous undertaking, and the results have sometimes been disappointing. The grinding or roaring tinnitus is usually not alleviated and in some cases cerebellar disturbances and difficulty with balance remain even though the acute vertiginous attacks disappear. Partial or total nerve section would seem to be an illogical treatment for this condition, as it does nothing towards attacking the seat of the trouble, namely, hydrops of the labyrinth. I believe that any surgery performed should be upon the labyrinth itself and should include opening the membranous labyrinth to release some of the endolymph. There have been few reports of labyrinth surgery for this condition. Portmann's[4] endolymphatic sac operation has relieved some cases, although the relief has often been only temporary. In England, the operation of choice seems to be alcohol injections into the labyrinth as reported by Wright[6] and Mollison,[3] either through the drum and oval window or through a trephine opening in the horizontal canal. This procedure causes complete destruction of the cochlea and vestibule and not infrequently has caused facial paralysis. It has found little favor in this country. Putnam[5] reported two cases in which he opened the superior semicircular canal by way of the middle cranial fossa and used a coagulating current to destroy the vestibule without destroying the cochlea. His procedure seems to me to have considerable merit except for the fact that his approach is unnecessarily circuitous.

My procedure is as follows: A partial simple mastoidectomy is performed by the postauricular route, opening the antrum widely and removing the outer wall of the aditus far enough to expose the short process of the incus. With a small motor-driven burr, the horizontal canal is opened medially to the short process. The opening is made in this portion of the horizontal canal since it is near the ampulla and through an opening at this point a needle can be passed forward through the canal into the vestibule. When the point of the needle strikes the anterior wall of the vestibule it is then slightly withdrawn and pressed towards the medial wall so as to avoid the facial nerve. A light coagulating current is then used for two or three applications of about one second each. A few sulphonamide crystals are then dusted into the cavity and the mastoid incision is completely closed with clips. The clips are

removed on the fourth day and the dressing usually discarded by the sixth day.

I have carried out this operation on eight patients suffering from Ménière's Syndrome whose symptoms and signs suggested a hydrops of the labyrinth. Six of these patients had unilateral involvement and two had bilateral involvement. The elapsed time since operation has been from one to three years in six cases and I believe this is sufficient for a true evaluation of the results, although it is known that in some instances spontaneous remissions for months or even years may occur. In all cases to date, the procedure has resulted in a complete loss of vestibular response to caloric stimulation. The hearing has varied markedly. In two cases there was total loss of hearing. In two cases hearing has remained at essentially the same level as before operation. Three cases showed further loss of hearing chiefly in the lower tones following the operation. In one case in which there was a uniform preoperative loss of hearing of about 70 dcb., the hearing since operation has returned almost to normal and has remained so for a year and a half. The six patients with unilateral involvement have been free of vertiginous attacks since operation. Some had almost immediate relief from vertigo while in others it took from two to three months before the other labyrinth completely adjusted. The degree of postoperative vertigo and imbalance seemed to be directly proportional to the labyrinthine activity in the affected ear as shown by caloric tests before operation. These six patients have been rehabilitated and have returned to their normal life and all have been most grateful for the operation. Moreover, the low pitched grinding or pounding tinnitus has been completely relieved, although there has been little effect on the high pitched tinnitus, which in some cases increased. None of these patients has complained about the high pitched residual tinnitus: Two of them say that the pounding tinnitus before operation was as bad as the vertigo. In the two bilateral cases the desired results were not attained. Unfortunately, these were the two cases in which complete loss of hearing resulted in the ear operated upon. It was hoped that enough hearing would be preserved in the ear operated upon to warrant a later operation on the other ear without endangering the ability to hear. Fortunately one of these patients re-

sponded later to histamine therapy and has been rehabilitated at least for the time being. It is curious to note that before operation this patient had an extensive course of histamine therapy without any relief and had given it up. There were no postoperative complications in any of the cases in this series. The wounds all healed by primary intention. Patients were well enough to be discharged from the hospital in from one to three weeks, depending upon the amount of postoperative physiological labyrinthitis from the unaffected ear. Incidentally, no gross distention of the membranous horizontal canal was noticed in any of these cases at operation.

In commenting upon the effect of the coagulating current in the vestibule in this operation I can only conjecture as to what actually happens. The idea of using the coagulating current is to destroy the vestibular mechanism with as little damage as possible to the cochlea. The coagulating current may result in actual coagulation of a part of the membranous organ so that the cochlea seals off from the vestibule and the endolymphatic fluid in the former is not lost. This would account for continued cochlear function postoperatively. A needle passed through the horizontal canal into the vestibule would lie above the utricle and would perforate only the horizontal canal and its ampulla, unless the utricle were so greatly distended as to fill all available space. Whether the current destroys or coagulates the utricle and perhaps the saccule and thus destroys the vestibular function I do not know. It may be that the current destroys the nerve fibers of the branches of the vestibular nerve to the utricle and superior semicircular canal which lie in the immediate vicinity of the end of the needle. It is hoped that we may be able to obtain sections of some of these labyrinths for pathological study at some future time. I can offer an explanation for the complete loss of cochlear function in two cases. I think this was due to using the coagulating current when there was too little fluid inside the bony labyrinth, and it resulted in a complete loss of endolymph. In these two cases, the labyrinth appeared to be empty after coagulation. It was not until I operated on the second case that I arrived at this conclusion. It has been my practice to flush out with saline the bone dust and debris from the mastoid cavity and then remove it with suction. I believe in these two cases the suction tip was

allowed to come too close to the opening in the canal and resulted in removing part of the labyrinthine fluid.

This operative procedure is not perfected and must be considered as still in the experimental stage insofar as preservation of hearing is concerned. Nevertheless, I think it deserves to be reported at this time since it has proven so successful in accomplishing its primary purpose, that of relieving the vertiginous attacks of Ménière's Disease. It is hoped that with some modification there may be better assurance of the preservation of hearing. I am offering this in the hope that others may try out my procedure and help attain this goal. Animal experimentation and pathological examination of postoperative labyrinths are particularly desirable.

CASE REPORTS.

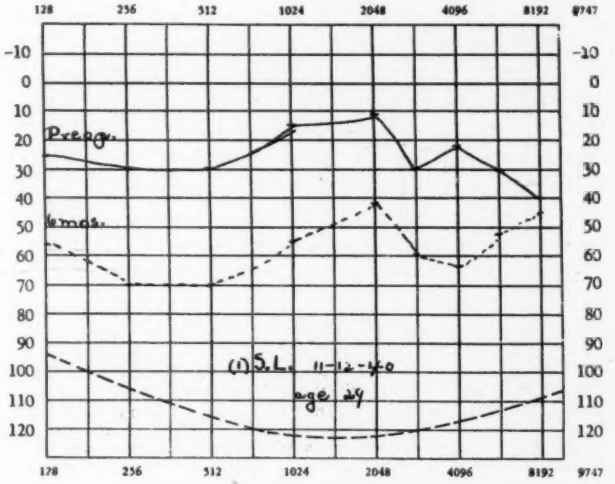

Fig. 1.

Case 1: S. L., male, age 29, coal miner. Attacks of vertigo with low toned tinnitus right ear seven years, increasing in frequency and severity. Deafness not noticeable. Incapacitated three months with almost daily attacks. Frequent right-sided headaches. Had been hospitalized and treated with salt-free diet without effect. General physical examination negative. Allergy study negative. Slight deafness for low and high tones right ear with decreased bone conduction. Weber test lateralized to left ear. Caloric tests — hypoactive response from right ear, normal left ear. Nov. 12, 1940, right labyrinthotomy with coagulation. Postoperative labyrinthine reaction for one week. Instability on quick movements

for six weeks. Back to work after six weeks and worked steadily for next nine months when contact with patient was lost. Audiograms showed uniform hearing loss throughout the scale averaging about 60 dcb. Tinnitus not noticeable. No vertigo attacks since operation.

Result: Rehabilitated.

Case 2: M. W., female, age 31. Rough, low pitched pounding tinnitus right ear three years. Deafness and attacks of vertigo for two years. In bed about half of the time. Had bilateral sphenoid operation, also treatment with salt-free diet and histamine without effect. Allergic tests negative. Examination: severe uniform deafness right ear with decreased bone conduction. Caloric tests showed no response from right ear or left

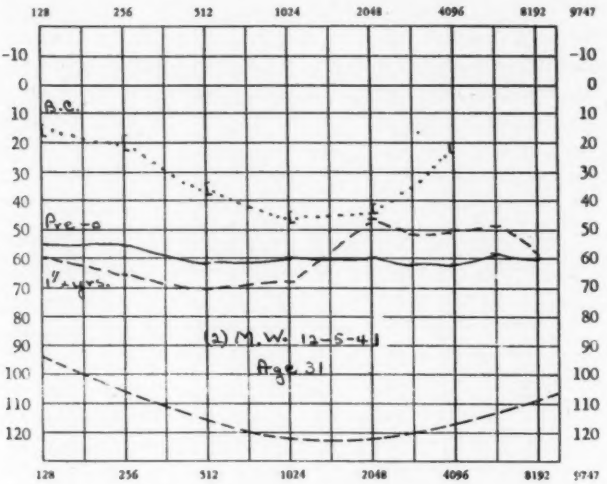

Fig. 2.

vertical canals, hypoactive response left horizontal canal. Dec. 5, 1941, right labyrinthotomy with coagulation. Slight postoperative labyrinthine imbalance. Full diet next day. Eighteen months postoperative, patient working in a defense plant. Had gained 30 pounds, has had no vertigo since operation. Pounding tinnitus gone. Hearing practically unchanged. Occasional slight high pitched ringing.

Result: Rehabilitated.

Case 3: M. D. R., male, age 55. Attacks of vertigo associated with varying deafness left ear for eight years. Onset of attacks with pounding roar in left ear "worse than a machine shop." Much treatment with drugs and diets. Last attack while driving car and crashed into telephone pole. Examination: severe uniform deafness throughout the scale with decreased bone conduction left ear. B. P. 160/90. Caloric tests: No response left vertical canals, minimal response left horizontal canal. Right ear — hypoactive response. March 6, 1942, left labyrinthotomy with coagulation. No postoperative dizziness. Sat up next day, immediate relief from loud tinnitus, marked improvement in hearing. Eighteen

months postoperative, hearing remains good. No recurrence of vertigo. Slight occasional tinnitus like "frying bacon." Working on farm.

Result: Rehabilitated.

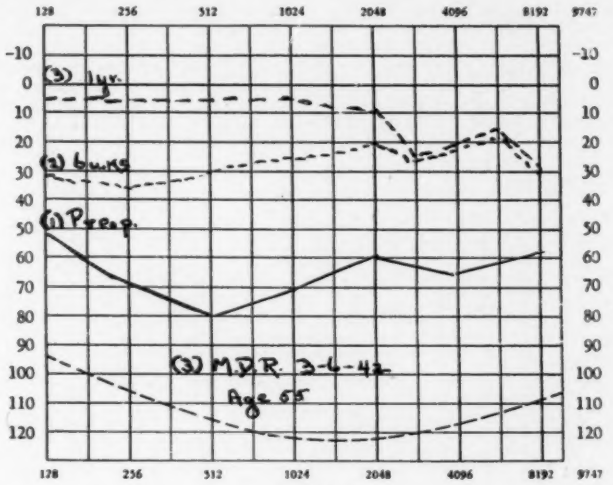

Fig. 3.

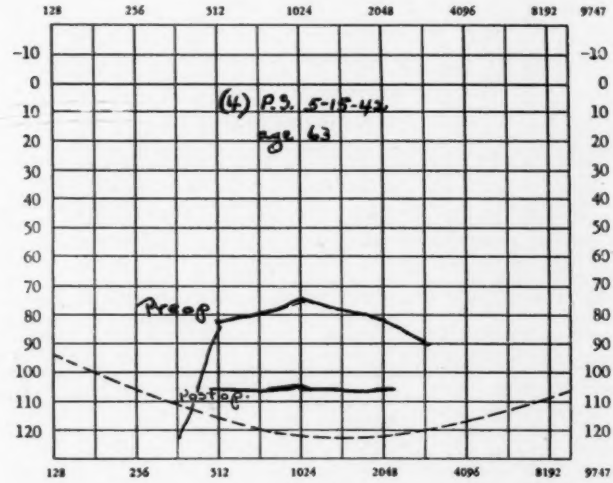

Fig. 4.

Case 4: P. S., male, age 62. Attacks of deafness right ear 30 years, vertigo 20 years with loud roaring at onset of attacks. Residual hearing present right ear. Left ear affected 1½ years with increasing deafness

and more frequent attacks of vertigo. Much ineffective treatment. Caloric tests — very slight response right ear, subnormal response left ear. May 15, 1942, right labyrinthotomy with coagulation. Too much coagulation and fluid boiled away, resulting in total deafness right ear. No postoperative vertigo and less tinnitus. Hearing in left ear improved so patient could use a hearing aid on it. Free of attacks for two months. Hearing left ear would be fairly good in morning and gradually get worse during day. Two and one-half months postoperative had recurring attacks from left ear, not so severe as before operation. Hearing would get suddenly better during attacks and be worse after having them. Histamine therapy which was ineffective before operation was again tried and proved effective in controlling attacks and improving hearing in left ear.

Result: Poor.

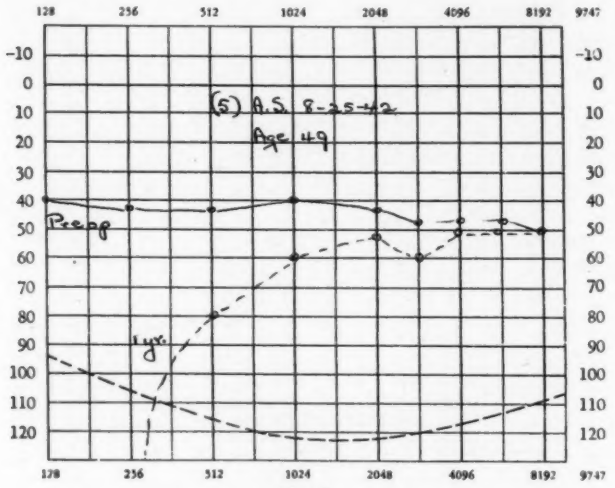

Fig. 5.

Case 5: A. S., female, age 49. Attacks of vertigo left ear for four years, associated with deafness and loud roaring tinnitus, unsteadiness between attacks. Ineffective treatment, diet, nicotinic acid, thiamin chloride. Caloric tests showed normal response right ear, hypoactive left ear. Aug. 27, 1942, left labyrinthotomy with coagulation. Moderate labyrinthine upset one week postoperative. Some unsteadiness two months. Unsteady in the dark three months. One year postoperative, no vertigo attacks, slight high pitched hissing tinnitus. Pounding tinnitus completely gone. Patient claimed the tinnitus had been as bad as the vertigo before operation. Unnoticeable loss of hearing for low tones, higher tones showed little change.

Result: Rehabilitated.

Case 6: F. C. I., male, age 27. Progressive deafness right ear eight years. Vertigo attacks two years. Tinnitus *not* an active factor. Ineffective treatment with salt elimination, nicotinic acid and thiamin chloride. Caloric tests showed minimal reaction right ear and decreased response from left vertical canals. Aug. 27, 1942, right labyrinthotomy with coagulation. No postoperative vertigo, uneventful recovery, hearing practically un-

changed. One year postoperative, has gained weight. No vertigo. Working in a defense plant.

Result: Rehabilitated.

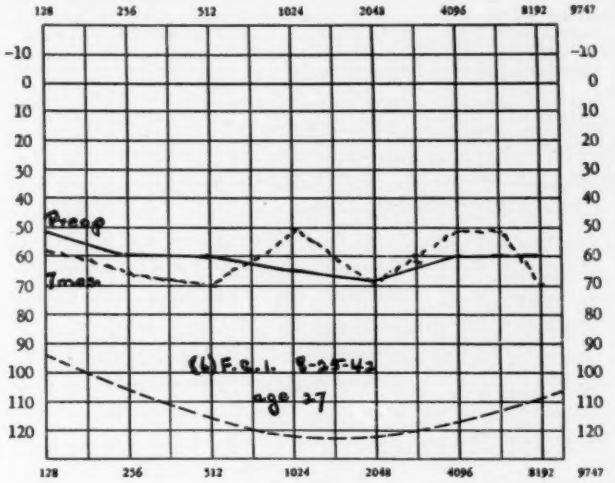

Fig. 6.

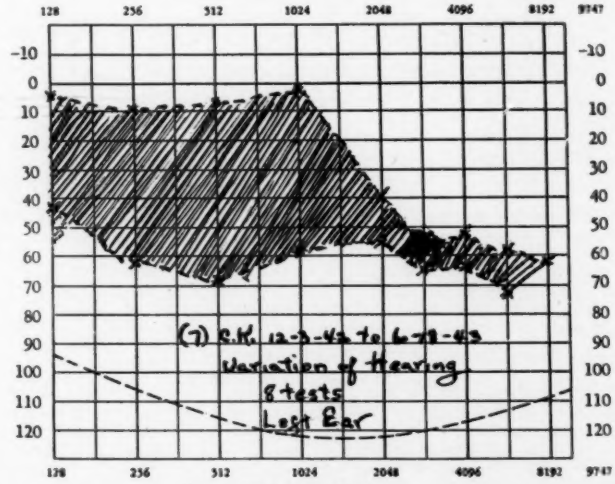

Fig. 7 (Case 7).

Case 7: C. K., male, age 56. Deafness and roaring right ear seven years with vertigo attacks four years. Vertigo attacks somewhat relieved by treatment with nicotinic acid but no effect on hearing or tinnitus. For

two years left ear had been pounding worse than right with varying deafness which has been gradually getting worse. Patient was very sensitive to histamine and allergic to many tests but failed to respond to histamine therapy, diet and removal of offending allergens. Patient's father had committed suicide and patient threatened to do likewise. One daughter also has Ménière's disease. Audiograms over period of year showed uniform deafness right ear with only moderate variations. Left ear wide variations in lower scale from normal to 50 dcb. loss. Upper

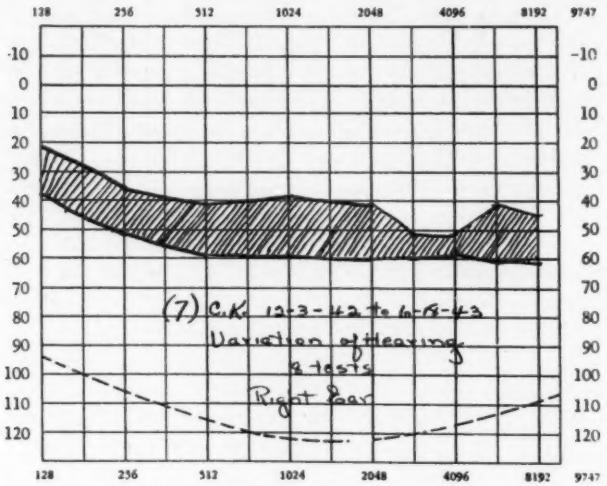

Fig. 8 (Case 7).

scale constant loss of about 50 dcb. For the past six months deafness of left ear became more profound with fewer and shorter remissions. Caloric tests — no response from vertical canals. Slight response horizontal canals. A. U. June 18, 1943, left labyrinthotomy with coagulation. Fluid in vestibule boiled away, resulting in complete deafness left ear. Moderate labyrinthine upset two weeks postoperative with unsteadiness two months. Several mild vertigo attacks at intervals of one to two weeks. Very despondent. Roaring left ear better but right ear continues. Will not tolerate hearing aid right ear, says too much distortion and sounds painful.

Result: Bad.

Case 8: E. R., male, age 43. Reduced hearing with throbbing low pitched tinnitus left ear about 10 years. Attacks of vertigo with nausea, vomiting and loss of consciousness seven-eight years. Attacks more frequent past two years with unsteadiness and vertigo between attacks. Ineffective treatment. Caloric tests showed diminished response both ears, left ear less active than right. Moderate uniform hearing loss left ear with decreased bone conduction. June 21, 1943, left labyrinthotomy with coagulation. Slight labyrinthine upset one week postoperative. Some unsteadiness and imbalance six weeks. Two months postoperative tinnitus not

noticeable. No dizzy attacks. Back at work, hearing worse, but not noticeable to patient.

Result: Good to date.

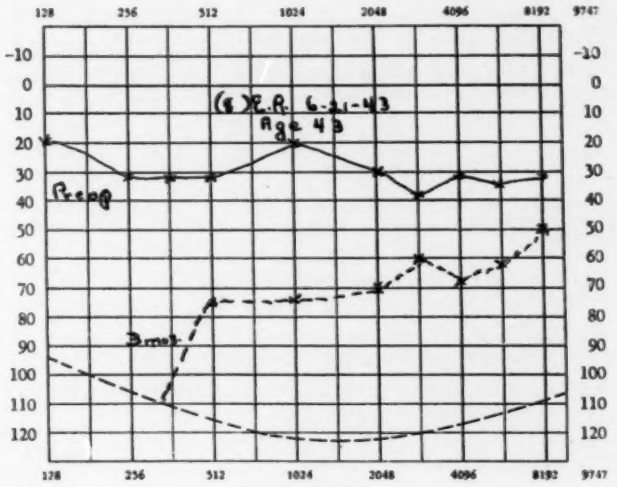

Fig. 9 (Case 8)

CONCLUSIONS.

1. The operative procedure here presented is still in its experimental stage.

2. The results in the above series of cases seem definitely to justify it as a surgical procedure for intractable cases of hydrops of the labyrinth.

3. It has proven successful in terminating the vertiginous attacks in such cases.

4. The effect on hearing has varied from restoration of normal hearing to a complete loss.

5. The low pitched pounding or grinding tinnitus has been eliminated by this procedure, although high pitched tinnitus has sometimes increased.

6. This procedure seems to be preferable to that of sectioning the vestibular nerve in its results, simplicity and safety.

7. The procedure seems justified only in cases of labyrinthine distention or hydrops which fail to respond to medical

therapy, or where complete destruction of the labyrinthine function is desired.

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CASSELBERRY AWARD OF THE AMERICAN LARYNGOLOGICAL ASSOCIATION.

A sum of money having accrued from the Casselberry Fund of the American Laryngological Association, a prize will be offered in 1944 for original investigation in the art and science of laryngology or rhinology. Theses must be in the hands of the Secretary, Dr. Arthur W. Proetz, 1010 Beaumont Building, St. Louis 8, Mo., before March 1, 1944.

BARTHOLOMAEUS EUSTACHIUS.
HIS CONTRIBUTION TO THE ANATOMY OF THE EAR, LARYNX AND BRONCHI.*

DR. CHARLES J. IMPERATORI, New York.

"Almost[1] all scientists and technicians develop an interest in the history and progress of their science after they have acquired enough experience to realize that some of their predecessors" have possessed many of the basic ideas and facts that have been studied and elaborated upon by succeeding generations.

Many of the superb works of the early writers and masters in their particular field remain immured in archives or just as securely locked up in untranslated volumes of Latin script or foreign languages, just as the "Pirotechnia" of Biringuccio, published in 1540, was passed over most recently by the Hoovers in their translation of Agricola's De Re Metallica.

The accomplishment of a translation well done of any work is an indication that the translator's imagination has been so stimulated by the author that he can transpose the thoughts and ideas of the originator into another language, so that it is readable and understandable.

The magnificent anatomical drawings of Leonardo da Vinci were lost for over 400 years, and have only been known generally for the past 40 years. Similarly, the anatomical sketches and drawings of Eustachius were lost for over 140 years. The anatomical achievements of both Leonardo and Eustachius were much greater than the influence exerted.

In the Opuscula Anatomica,[2] Fig. 1 and Fig. 2, which Eustachius published in 1564, there were but eight plates. These illustrations were of the kidney, Fig. 3, veins of abdomen, azygos vein, the heart and its valves, and two small illustrations of the bones of the middle ear and tensor tym-

*Read at the Forty-eighth Annual Meeting of the American Academy of Ophthalmology and Otolaryngology, Chicago, Oct. 12, 1943.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Sept. 21, 1943.

Fig. 1.

TITLE PAGE OF THE OPUSCULA ANATOMICA.

"The anatomical works of Bartholomaeus Eustachius, the Sanseverino Physician and Philosopher.

The number of these works and their arguments are indicated on the reverse page.

With the Patronage of the Highest Pontiff, of the Illustrious Senate of Venice, of His Catholic and Imperial Majesty, King of France.

Venice, 1564.

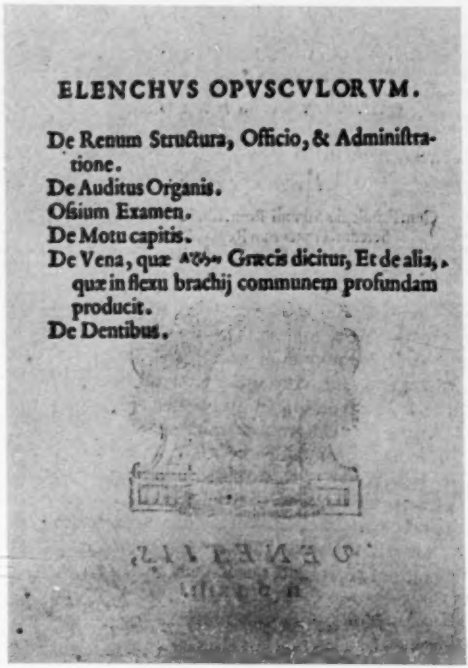
Published by Vincentius Luchinus."

NOTE: The signature of A. Flint, Jr., indicating ownership of this volume, is that of Austin Flint, Jr., Professor of Physiology at the Bellevue Hospital Medical College, circa 1880-1898. He was a collector of rare medical books. He was the son of Austin Flint, the great clinician and heart specialist of the post-Civil War days, and who practiced in New York City and was Attending Physician to Bellevue Hospital. The present Austin Flint was also known as A. Flint, Jr., he being the son of the A. Flint, Jr., whose name is on the title page. He was Professor of Obstetrics at the Bellevue Hospital Medical College and Visiting Surgeon to Bellevue Hospital. He is now living in retirement at Millbrook, N. Y.

The writer had the privilege of having been a medical student under these two distinguished teachers.

pani muscle. Similar illustrations of the ossicles, the middle ear, the cochlea and the semicircular canals are shown in the Tabulae Anatomicae.[3] These are the copper plate engravings

that were not published until 140 years after Eustachius' death. Other illustrations of the bones of the face, skull and bronchial tree and accompanying blood vessels, are part of these Tabulae, Fig. 4. No illustrations nor descriptions of the accessory nasal sinuses are given. Examination of these illus-


ELENCHVS OPVSCVLORVM.

De Renum Structura, Officio, & Administratione.
De Auditus Organis.
Ofsium Examen.
De Motu capitis.
De Vena, quæ Ἄζυγος Græcis dicitur, Et de alia, quæ in flexu brachij communem profundam producit.
De Dentibus.

Fig. 2.

REVERSE SIDE OF TITLE PAGE. OPUSCULA ANATOMICA. "AN INDEX OF THE WORKS.

The Structure, Function and Care of the Kidneys.
The Organs of Hearing.
The Examination of Bones.
The Movements of the Head.
The Vein which the Greeks call azygos, and other things, which, when bending the arms, produce a common depression.
The Teeth."

NOTE: The outline of the frontispiece and some of the printing (Venetis MDLXIIII) etc., can be seen coming through the paper.

trations of the frontal bones and the superior maxilla would convey the impression that they were not present. These Tabulae were drawn by Eustachius himself and his relative and assistant, Pier Pini of Urbino, and were engraved by

deMusi of Rome. This engraver was one who had done considerable work in architectural lines and this probably accounts[4] for the fact that the engravings are lifeless and stiff, and not at all adequate representations of living parts. As noted elsewhere, only eight illustrations, composing the total

Fig. 3.

EXPLANATION OF THE ILLUSTRATIONS SHOWING THE OSSICLES IN TABULA SEPTIMA, OPUSCULA ANATOMICA.

"Two small shapes or figures relating to the organ of hearing; three small bones hidden in the cavity of the stone-like bone, the main muscle is adapted to their movement — in fact, to a higher degree in Man, while quite less so in a dog.

A small, anvil-like bone 8.16 and 48.19

A small bone which corresponds to the hammer 9.15 and 49.20

A small bone, comparable with a so-called "stirrup" 19.18 and 49.18 — overlooked (disregarded) by Vesalius

A muscle which every anatomician well knows, connecting with the major bone formation referred to as "the hammer." In the dog, however, a small horn-like gland is attached to it 11.18 and 51.16."

of 47, were published during the lifetime of Eustachius. The remaining 38 copper plates were intended for his great work, "De dissensionibus ac controversiis anatomicis"; however, he died (1574) before his work was completed. In all, there are 47 (illustrations) engravings on the copper plates. One plate was engraved on the reverse side. These are the original

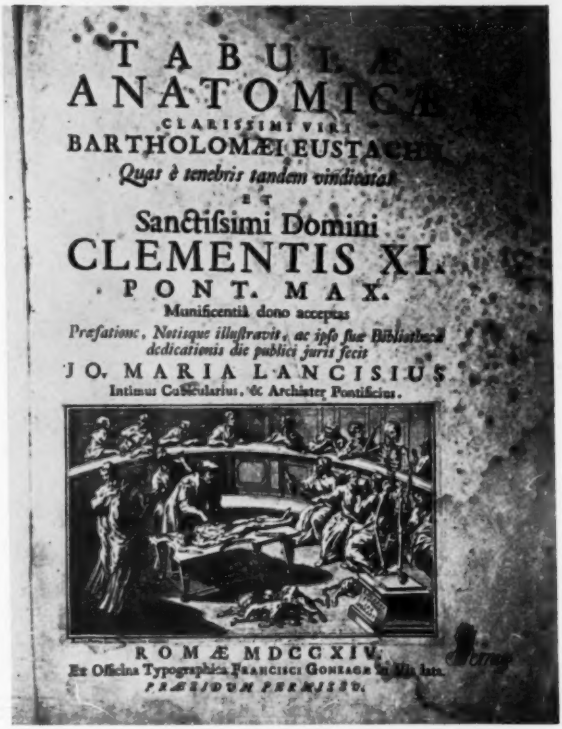


Fig. 4.

TITLE PAGE OF THE TABULAE ANATOMICAE
"THE ANATOMICAL TABLES
of
EXCELLENCY BARTHOLOMAEUS EUSTACHIUS

rescued from the darkness (of oblivion) and graciously accepted by virtue of the generous donation of His Holiness Clement XI, the Highest Pontiff, and published by Jo. Maria Lancisius, Personal Physician and Chamberlain of the Pope, with a Foreword, Notes and Dedications from his own Library.

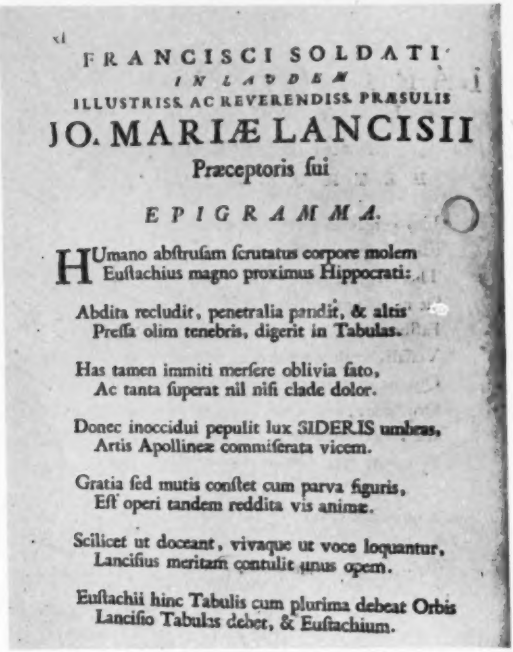
Rome, 1714.

Printing Shop of Franciscus Gonzage, on the Via Lata — with the permission of the Governors."

NOTE: The signature of J. W. W. Werner may have been the Johann Wilhelm W. Werner born in 1715, and who became Professor of Medicine at the University at Halle. This may have been his book.

plates published by Lancisi with his own commentaries, and copied and recopied by others.

Jo Maria Lancisi was physician to Pope Clement XI and the volume "Tabulae Anatomicae" was dedicated to him.



FRANCISCI SOLDATI
IN LAUDEM
ILLUSTRISS. AC REVERENDISS. PRÆSULIS
JO. MARIÆ LANCISII
Præceptoris ſui
EPIGRAMMA.

HUmano abſtruſam ſcrutatus corpore molem
Euſtachius magno proximus Hippocrati:

Abdita recludit, penetralia pandit, & altis
Preſſa olim tenebris, digerit in Tabulas.

Has tamen immiti merſere oblivia fato,
Ac tanta ſuperat nil niſi clade dolor.

Donec inoccidui pepulit lux SIDERIS umbras,
Artis Apollineæ commiſerata vicem.

Gratia ſed mutis conſtet cum parva figuris,
Eſt operi tandem reddita vis animæ.

Scilicet ut doceant, vivaque ut voce loquantur,
Lanciſius meritam contulit unus opem.

Euſtachii hinc Tabulis cum plurima debeat Orbis
Lanciſio Tabulas debet, & Euſtachium.

Fig. 5.

PAGE 40, LANCISI, TABULAE ANATOMICAE.
"EPIGRAM
of **Franciscus Soldatus,**
in honor of his teacher,
the Illustrious and Reverend President
JO. MARIA LANCISIUS.

Eustachius, who is next to the great Hippocrates, he who has investigated the abstruse mass in the human body, reveals hidden secrets, unfolds the innards and orders into Tables that which once was in darkness. Yet, harsh fate has made these Tables sink into oblivion, and so much loss does not even exceed the suffering. Until the light of the never-setting SUN dispersed the shadows, having taken pity on the vicissitudes of the Apollonean Art. Yet, small drawings do little good, and at last the vital strength has been restored to the work. Let them teach, let them speak aloud, a Lancisius has brought us a meritorious work. Hence, let the world owe a debt of great gratitude to the Eustachian Tables; to Lancisius it owes the Tables — and Eustachius."

There is also included a testimony of praise, a laudatory poem and several letters, relating to the compiler and author, Eustachius (Fig. 5).

In that year, 1714, Lancisi had printed the 47 engravings and included a description of the anatomical parts and also indicated the structures after the manner of Eustachius; that

is, each detail of the illustration could be located by the numbers on the border, both vertical and horizontal and intersecting them with a ruler, as one does on a map with the given co-ordinates.

In 1744, Bernardi Siegfried Albini[5] published a volume describing and explaining the same engravings, and it would

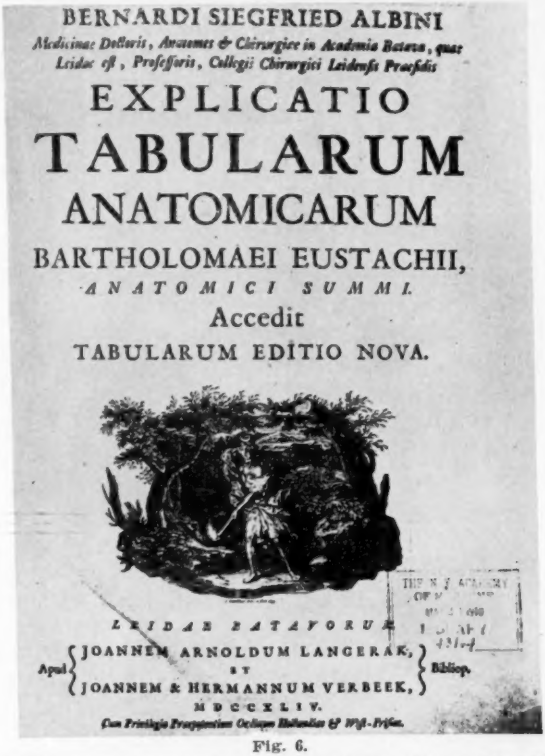

BERNARDI SIEGFRIED ALBINI
Medicinae Doctoris, Anatomes & Chirurgiae in Academia Batava, quae Lugduni est, Professoris, Collegii Chirurgici Lugduni Praesidis
EXPLICATIO
TABULARUM
ANATOMICARUM
BARTHOLOMAEI EUSTACHII,
ANATOMICI SUMMI.
Accedit
TABULARUM EDITIO NOVA.
LUGDUNI BATAVORUM
Apud { JOANNEM ARNOLDUM LANGERAK, ET JOANNEM & HERMANNUM VERBEEK, } Bibliop.
MDCCXLIV.
Cum Privilegio Praestantium Ordinum Hollandiae & Westfrisiae.

Fig. 6.

TITLE PAGE. EXPLICATIO TABULARUM ANATOMICARUM.

"Explanation of the Anatomical Tables of the greatest anatomist, Bartholomaeus Eustachius, by Bernardus Siegfried Albinus, Doctor of Medicine, Professor of Anatomy and Surgery at the Academy of Holland in Leyden, President of the Surgical College of Leyden. Ninth Edition of the Tables. Leyden, Holland. Printed by Joannes Arnoldus Langerak and Joannes Hermann Verbeek, Printers. 1744."

seem from comparison of the plates that most of these illustrations were copies of the Tabulae Anatomicae of Lancisi. This volume of Albini was entitled, "Explicatio Tabularum Anatomicarum of Bartholomaei Eustachii" (Fig. 6). Albini

used line drawings, with numbers, to indicate the various anatomical parts. The original Tabulae of Eustachius were copied and plagiarized, the last volume appearing in 1800. Copies of copies of the original Tabulae have been made, and many controversies regarding them have arisen. Had these plates appeared in 1552, when they were completed, Eustachius would have equal status with Vesalius (circa 1514-1564) as one of the founders of Modern Anatomy.[6] The "Fabrica" of Vesalius is to this day a wonderful and superlative collection of illustrations of human anatomy, but in comparison with Eustachius, Vesalius is not so accurate. In the multitude of discoveries, Eustachius has only Vesalius and Leonardo da Vinci as superiors. Unfortunately, the Tabulae did not appear until over 140 years later, and even then, they were hailed as masterpieces. To a great extent, they were excellent for teaching purposes. Aside from the general anatomy depicted in the 47 Tabulae, and only seven of which had accompanying descriptions by Eustachius, there were several very special studies made by him.

A meager description[7] of the tuba auditiva is found in the Opuscula in a chapter in that work. It is really a letter addressed to Francesco Alciato, dated October, 1562, from Rome. No illustration of the tube is found in any of the Tabulae Anatomicae. He also described the malleus,[8] incus and stapes and in his Opuscula Anatomica compared that of the human ossicles with that of the dog. A description of the tensor tympani is also given, including its attachment to the major process of the malleus. These anatomical details are all carefully annotated with numbers of the upper, lower and side co-ordinates of the Tabula septima of the Opuscula Anatomica. There is no description of the stapedius muscle.

Of course, it was known to the ancients, as stated by Aristotle,[9] that there "is no passage from the ear to the brain but there is one to the roof of the mouth." Alcmaem, who discovered the optic nerve and also the tuba auditiva, assumed from his dissections which were done on goats, that they breathed through their ears; however, no one ever named the tube. Eustachius named the central bony column of the cochlea as the modiolus.[10]

Portal[11] in his Histoire de L'Anatomie states that "Eustache has made important discoveries about the ear. He is the

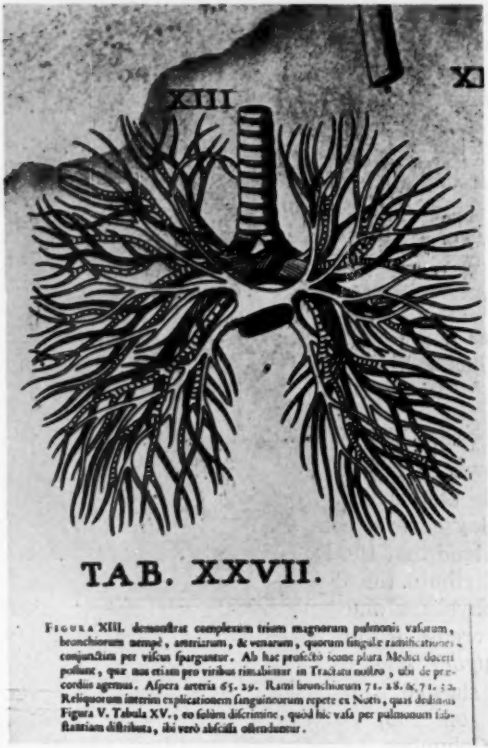

XIII
XI
TAB. XXVII.
FIGURA XIII. demonstrat complexum trium magnorum pulmonis vasorum, bronchiorum nempè, arteriarum, & venarum, quorum singulæ ramificationes, conjunctim per viscus spargantur. Ab hac profectò scenæ plura Medici docere possunt, quæ nos etiam pro viribus rimabimur in Tractatu nostro, ubi de præcordiis agemus. Aspera arteria 65. 29. Rami bronchiorum 71. 28. & 71. 30. Reliquorum interim explicationem sanguineorum repete ex Notis, quas dedimus Figuræ V. Tabulæ XV., eo solùm discrimine, quod hic vasa per pulmonum substantiam distributa, ibi verò abscissa offerebantur.

Fig. 7.

TABULA 27, PAGE 66, LANCISI, TABULAE ANATOMICAE.

"Drawing XIII shows the relationship of the pulmonary vessels, as well as the bronchi, arteries and veins, the individual ramifications of which unitedly spread throughout the innards of the body. Medical men can learn much from this cross-section picture, which we shall also thoroughly investigate in the course of our treatise where we shall deal with the heart region. — The artery 65.29. The branches of the bronchi 71.28 and 71.30. In the meantime, review the explanation of the rest from the Notes given in Drawing V, Table XV, with the only distinction that while here the vessel is distributed throughout the lung substance, there separations are clearly evident."

first who knew the canal, which on one side opens into the tympanum and on the other side into the back part of the nostrils. He has discovered the malleus muscle (tensor tympani) and indicated the origin and course of the nerve which winds in the interior of the drum (chorda tympani). He also has given an exact description of the limacon (snail) cochlea.

The canal of communication between the nose and the ear, he has said, has the form or shape of a quill. . . Although Eustache could have claimed this discovery, as none of the ancient anatomists had spoken directly of this canal, he did not feel embarrassed to give it his name. Eustache has acquired an immortal reputation for himself and nobody has ever refuted that he did not discover the tube."

The controversy regarding the discovery of the stapes seems to have been decided by Portal in favor of Eustachius.

The illustration of the Tabulae septima of the Opuscula Anatomica is the only illustration that contains special anatomy that has been described by Eustachius (Fig. 3).

Portal states, "Eustache has mentioned three ossicles of hearing, 'le marteau, l'enclum and l'etrier'.[12] The first two were known by Achillinus and by de Berenger Carpi. As to the third, (Eustache) attributes to himself. There are, he says, 'today several contests on the discovery of this bone. Some contend that the Roman anatomists did not know about it and attribute the discovery to Ingrassius, the celebrated Sicilian physician and philosopher. But whomever one might give the credit of this discovery, I (Eustache) testify that before anyone had spoken of it, wrote or published their works, I showed it to several persons in Rome and had it engraved on copper'." (Fig. 3). Portal continues: that Realdus Columbus (circa 1516-1559) also claimed the discovery of the stapes."

Realdus Columbus was the successor of Vesalius and wrote a textbook on anatomy that was published posthumously and was extensively used. He, it was, who described the turbinates and the mediastinum. Also, Gabriel Fallopius (circa 1523-1562), the discoverer of the aquaeductus Fallopi (facial nerve canal); F. hiatus (for the petrosal branch of the vidian nerve); F. muscle (pyramidalis); F. tube (oviduct); F. ligament (round ligament); F. valve (Ileocecal valve) also claimed to have discovered the stapes.

Because of these varying and controversial statements, Portal appears to be in a quandary, asking the reader "which one shall we believe?" He concludes by saying "if we can judge

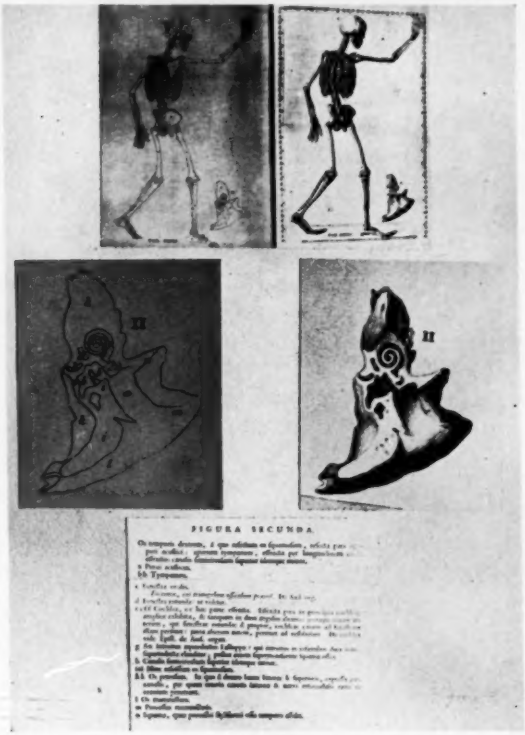


Fig. 8.

TABULA 45, ALBINI, EXPLICATIO TABULARUM ANATOMICARUM (Second Figure).

"Right temporal bone.

The squamous part has been removed and also the anterior part of the external auditory canal, the tympanum is exposed, showing a longitudinal section of the cochlea, also the superior semicircular canal.

a.—Ex. aud. canal
b.b.—Tympanum
c.—Fenestra ovalis
d.—Fenestra rotunda
e.e. and f.f.—Cochlea
g.—Aquaeductus Fallopio
h.—Superior semicircular canal
III—Section of squamous bone (process)
k.k.—Petrous bone (process)
l.—Mastoid
m.—Mastoid tip
n.—Squamous bone (process)."

This illustration of the temporal bone in Tab. 45 of Albini is a facsimile of the Lancisi engravings and a typical one in explaining the anatomical detail. Albini published his interpretation of the copper engravings of Eustachius thirty years after Lancisi. They are apparently copies of the Lancisi engravings and not of the original copper plates of Eustachius. Albini used a line drawing with numerals on opposite page to describe the illustrations. In this particular illustration (Tab. 45 of the second figure), it is placed in the vertical plane. In order to understand the anatomical details better, turn the drawing into the horizontal plane and at an angle of forty-five degrees. There is some slight distortion in the perspective. The artists of that day had but two planes in their conception of art. It was not until some years later that the conception of depth generally was understood and used in illustrations.

by the prodigious research that Eustache has made on the organ of hearing, he must be looked upon as the discoverer."[13]

In the Tabulae Anatomicae of Lancisi, Tab. XXVII, XIII, shows the trachea and bronchi with accompanying pulmonary veins and arteries.

The trachea is shown with nine rings (Fig. 7) and it would seem as though the general distribution of the bronchial tree was about equal in the right and left lung. The illustration also shows an equal sized right and left main bronchus. Unfortunately, it was unknown, at that time, that Leonardo da Vinci (1452-1519)[14] had shown split sections of the body in his anatomical drawings. If this advance in anatomy had been known by Eustachius and Vesalius, it would have been of great interest to have compared their illustrations with our modern ones. In Figs. 8, 9 and 10 will be found anatomical drawings by Eustachius that are of interest to otolaryngologists.

There exists in Sanseverino, a marble bust of Eustachius (Fig. 11) made by Ercole Rosa. There is also another rather idealized one[15] in Rome. The former shows a strong featured man with a prominent nose, deep-set eyes and a long beard. He is clothed with an academic cap and gown that has a fur collar on it and puffed sleeves in the then prevailing style of professional men. He also is invested with a medallion hanging from a chain around his neck. One would conclude that most likely this effigy represents him toward the end of his life and would seem to be a man over 50 years of age. In the engraving that illustrates the frontispiece in Lancisi Tabulae Anatomicae of the Eustachii, it shows a demonstration of anatomy by a Professor or Doctor in a "Theatrum Anatomicum" (Fig. 4). The demonstrator is the only one present who has his hat on. The associates, assistants and others are uncovered. A lecture is being given on a prepared dissection and the demonstrator, whom we are to assume is Eustachius, is indicating by pointing with his index finger, probably to the heart. The instruments for dissection are on the table which is of special construction. These instruments shown would seem to be those used in conducting a necropsy, and it is conceded that Eustachius established this practice[16] in the Roman hospitals, not so much for anatomical purposes, but to determine the cause of death. This engraving was made by Pier Ghezzi (circa 1674-1755). He was an engraver whose finest work was done in architectural lines. He was not the

engraver who made the Tabulae. They had been made by deMusi some 140 years previously. The date of his (Eustachius) birth is variously given as 1500 to 1520. He was a linguist and well versed in the Greek and Arabic languages. He became Professor of Medicine at the Studeo della Sapienza in Rome and understood the value and importance of anatomy and pathological anatomy. He[17] investigated the structure of

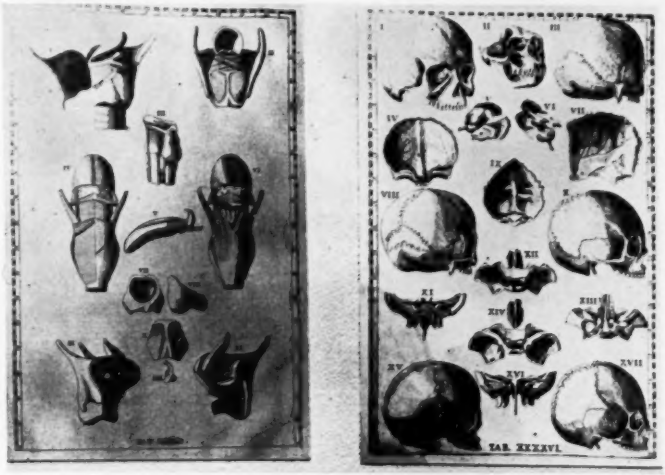


Fig. 9.

(A) EXPLANATION OF TABULA 42, LANCISI, TABULAE ANATOMICAE.
"Larynx with cartilages, muscles and one ventricular orifice, pharynx, hyoid bone and the tongue with various muscles."

(B) EXPLANATION OF TABULA 46, LANCISI, TABULAE ANATOMICAE.
The accessory pneumatic cavities (sinuses) are not shown. The lamina papyracea of the ethmoid is shown in Fig. 1, also the nasal and lachrymal bones. The sella turcica is shown. The perpendicular plate of the ethmoid and the cribriform and the crista galli are meagerly shown. The maxillary sinus is shown in Tab. 47, the illustration showing it from the inner and posterior aspect. Tab. 46 is not illustrated in this article.

the kidney, the teeth, the ossicles of the ear, the azygos vein, the ductus thoracious, the valve in the vena cava inferior, the cranial nerves, the muscles of the head and neck and the valves of the coronary veins. His name has been perpetuated by the tuba auditiva (Eustachian tube) and the valve in the fetal heart, being a membranous fold in the right auricle between the mouth of the inferior vena cava and the auriculo ventricular aperture.

Fig. 10.

TABULA 41, FIG. 13, ALBINI, EXPLICATIO TABULARUM ANATOMICARUM.

"K.K. The Extremity of the Bony Parts of the Eustachian Tubes.

The way to the nasal cavity opens from the cavern of the stone-like bone in which the auditory passage called 'Conchion' — ends. From this, in fact, starts another passage, like a small roundish channel, of which the width is similar to that of a thin reed, it proceeds, at a slant, to the inner frontal side of the base of the skull, and this entire bone penetrates and comes through K in the middle of four holes; at the rear seat of it, the soporary artery enters the Calvaria P; at the front seat, the yoke of the four skull (brain) nerves emerges H beyond it; the external side of the artery spreads out in the hard membrane of the skull, exposes the organ of hearing I; finally, the inner one is circumscribed by a certain fissure, which at the wedge and the extreme ends of the bone, at a slant below and before the ducts become M. Organ of Hearing."

NOTE: The "four holes" are interpreted to mean the carotid canal, the jugular fossae, the foramen spinosum and the foramen ovale; the "soporary" artery as the internal carotid and the "yoke of the four skull nerves" is interpreted to mean the branches of the Trigeminal nerve and subdivisions of the mandibular or inferior maxillary branch. The "certain fissure" is the middle lacerated foramen.

Most of Eustachius' work, — anatomical, literary and philosophical, was done in Rome. It would seem as though he had had very little communication nor was he influenced by the Northern Italian schools, where Vesalius had produced his De Fabrica.[18]

Eustachius was a great upholder of Galen, which would[19] appear rather paradoxical in the light of his very accurate anatomical drawings. It would seem that these illustrations would refute his Galenic tendencies. It must be remembered he was a physician in attendance at the Vatican (Pope Sixtus IV) and being the personal physician of Cardinal Rovere, later Pope Sixtus V, Galenic teachings and precepts were

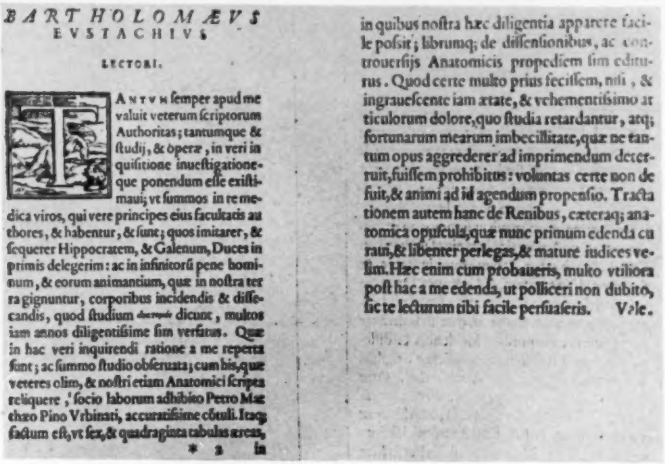
Fig. 11.

BARTOLOMEO EUSTACHI.

sacrosanct. It would require a strong-willed individual who would be willing to teach and expound their many fallacies, while still accepting the patronage of the Pontiff.

Whether or not Eustachius saw the De Fabrica of Vesalius. there is no record; however, it would seem that he knew about the teachings of Vesalius, for he defended Galen or rather he justified the accepted attitude of the constituted clerical tradition and authority. As stated elsewhere, by his accurate drawings of the Tabulae, he refuted these Teachings of Galen; but these Tabulae, with the exception of seven, were not published until 140 years after his death.

Vesalius refuted the contention that the structure of the human body had changed within the 1300 years since the Teachings of Galen. In expiation for this heresy, he made a pilgrimage to Jerusalem to propitiate those in authority. On his return journey from the Holy Land, his ship was wrecked and his death was shrouded in mystery.[20]



BARTHOLOMÆVS
EVSTACHIVS

LECTORI.

ANTVM semper apud me valuit veterum scriptorum Authoritas; tantumque & studij, & operæ, in veri inquisitione inuestigationeque ponendum esse existimaui, vt summos in re medica viros, qui vere principes eius facultatis autores, & habentur, & sunt; quos imitarer, & sequerer Hippocratem, & Galenum, Duces in primis delegerim: ac in infinitorũ pene hominum, & eorum animantium, quæ in nostra terra gignuntur, corporibus incidendis & dissecandis, quod studium ἀνατομὴν dicunt, multos iam annos diligentissime sim versatus. Quæ in hac veri inquirendi ratione a me reperta sunt; ac summo studio obseruata; cum his, quæ veteres olim, & nostri etiam Anatomici scripta reliquere, socio laborum adhibito Petro Matthæo Pino Vrbinati, accuratissime cõtuli. Itaq; factum est, vt fex, & quadraginta tabulas æreas, in quibus nostra hæc diligentia apparere facile possit; librumq; de dissensionibus, ac controuersijs Anatomicis propediem sim editurus. Quod certe multo prius fecissem, nisi, & ingrauescente iam ætate, & vehementissimo articulorum dolore, quo studia retardantur, atq; fortunarum mearum imbecillitate, quæ ne tantum opus aggrederer ad imprimendum deterruit, fuissem prohibitus: voluntas certe non defuit, & animi ad id agendum propensio. Tractationem autem hanc de Renibus, cæteraq; anatomica opuscula, quæ nunc primum edenda curaui, & libenter perlegas, & mature iudices velim. Hæc enim cum probaueris, multo vtiliora post hac a me edenda, ut polliceri non dubito, sic te lecturum tibi facile persuaseris. Vale.

* 2 in

Fig. 12.

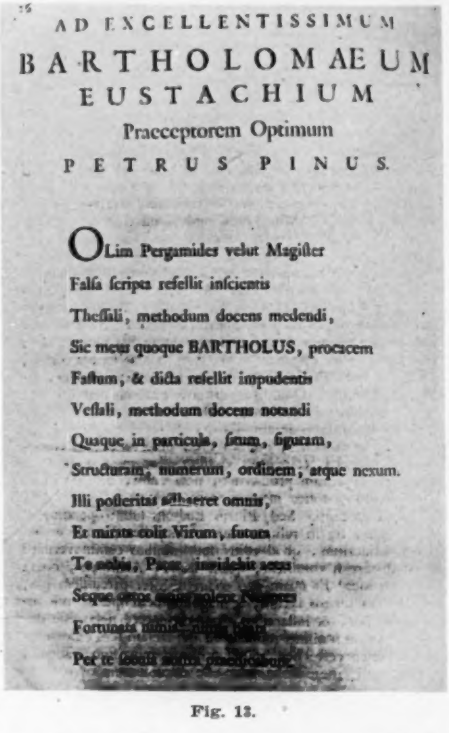
PAGES 2 AND 3 OF THE OPUSCULA ANATOMICA.

"BARTHOLOMAEUS EUSTACHIUS.

To the Reader.

I have always held in great respect the authority of the old writings, studies and works; I have had the opinion that they indeed are to be studied and investigated, as well as the greatest men of the medical profession, its true creators, whom I should imitate and should follow Hippocrates and Galenus, whom I would call the greatest leaders; also for many years already I have been well versed in cutting and dissecting bodies of almost all kinds of humans and other living beings born onto this Earth which science is called ANATOMY. In which study, many truths I have discovered and observed with utmost diligence; with these I have carefully compared that which is to be found in the writings of the ancient and also of our anatomicians, with the collaboration of the competent Petrus Matthaeus Pinus Urbinatus. Thus, it has been made possible that this endeavor of ours be shown in the data contained in forty-six Tables; soon I shall also publish a book on the dissensions and controversies among anatomicians. I certainly would have done this sooner had it not been for my advanced age and violent gouty pains in my joints, which have delayed my investigations; also the stupidity of my fate has made it impossible for me to elaborate so much work and to have it ready for printing. Certainly, it was not any lack of intentions on my part, and I have every intention to do so. Now, reader, I want you freely to peruse this treatise about the kidneys, and also the other anatomical works which I have now had published. First of all, I would like to have mature judgment. You will indeed verify this, many useful things are still to be published by me, which I can safely promise, so that you may easily pursue this lecture. Farewell."

To return to Eustachius, the implications are that he did not care nor dare to refute Galen and agree with Vesalius. They were both young men at the time. Vesalius, when he


AD EXCELLENTISSIMUM
BARTHOLOMAEUM
EUSTACHIUM
Praeceptorem Optimum
PETRUS PINUS.

OLim Pergamides velut Magister
Falsa scripta refellit inscientis
Thessali, methodum docens medendi,
Sic meus quoque BARTHOLUS, procacem
Fastum, & dicta refellit impudentis
Vesali, methodum docens notandi
Quaque in particula, sinum, figuram,
Structuram, numerum, ordinem, atque nexum.
Illi posteritas adhaeret omnis,
Et mirata colit Virum, futura
Te nobis, Pater, invidebit aetas
Sequo omne [illegible] nolens
Fortunata nimis [illegible]
Per te secula nostra praedicabunt.

Fig. 13.

PAGE 26, LANCISI, TABULAE ANATOMICAE.
"Petrus Pinus,
to that greatest of all teachers
EXCELLENCY BARTHOLOMAEUS EUSTACHIUS.

Once upon a time, Pergamides, as a Magister teaching how to heal, disproved the false writings of the ignorant Thessalius. The same way also my Bartholus, has rebutted the wanton pride and teachings of the impudent Vessalius, while teaching how to observe every single little piece, every location, shape, structure, number, order and connection. All posterity is his adherent and admiringly reveres this man. The future will envy us for you, Father, and the later generation will wish to have been born sooner. Our age will be praised as exceedingly happy and exceedingly lucky — on account of you."

completed the De Fabrica, was 29 years old, and, of course, at that period Eustachius was only 23 years old. The distance from Rome to Padua took a week to travel and heretical

teachings, while rapid in spreading, were nevertheless suppressed. Printed books were few and illustrated ones fewer.

In the introductory letter which Eustachius dedicates to his readers, he states that he has the greatest respect for the older authorities (Fig. 12). Nevertheless, he also remarks that he has discovered and compared them with the older and recent anatomists, and that he intended to show, in his "opus magnus," the dissensions and controversies among anatomists. He excuses himself because of his painful joints and advanced age, — approximately 53 years. He died in his fifty-fourth year. The controversy was still raging 140 years later, as evidenced in the inclusion of the poem by Petrus Pinus of Urbini in the Lancisi Tabulae Anatomicae (Fig. 13).

Petrus Pinus was the "competent collaborator" he mentions in the letter (Fig. 12).

CONCLUSIONS.

Eustachius was an anatomist of superior ability. Excepting for the seven illustrations in his Opuscula that were printed the year of his death, his great contribution to anatomy was not developed until nearly a century and a half afterwards. In this respect he parallels Leonardo da Vinci, whose work was not rediscovered for over 400 years. Nevertheless, the Eustachian Tabulae were in considerable vogue in medical circles from 1714 to 1800. The accuracy of most of the illustrations in the Tabulae are such that they might be used, — even today. It is unfortunate that these Tabulae were lost at a time when they would have been so valuable to the medical student. The evidence of their value is manifest, for, after 140 years, when they were recovered and released, they were used continuously for over 80 years in the teaching of anatomy.

Controversies of those days were bitter, and should they invoke one with the Church, retribution quickly followed. These Tabulae may have been suppressed.

Eustachius was in the midst of the Vesalian discussion and while he did not repudiate Galen, his accurate Tabulae Anatomicae definitely did so.

With but few exceptions, the brilliant men of that day rarely reached 50 years of life. Eustachius died when he was

54 years, while on a journey from Rome. His name attached to the tuba auditiva is just one of the mysteries that occur in anatomical nomenclature and as advanced by Portal "because of his researches and knowledge of its anatomy, he was not embarrassed to attach his name to it."[12] This statement implies that Eustachius was cognizant of this. Regarding his knowledge of the function and physiology of the tube, very little can be said. A very careful translation of his Opuscula may reveal some further facts in this regard. In

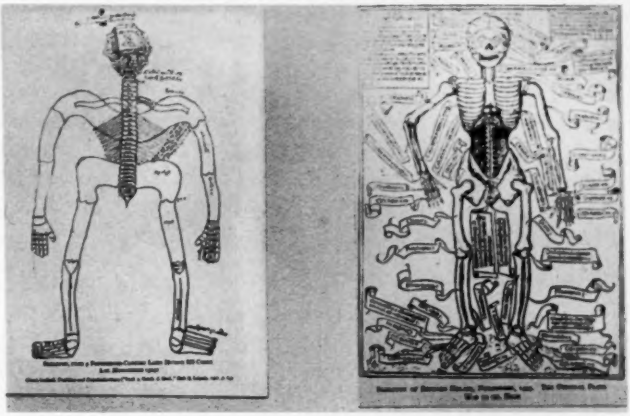


Fig. 14.

These illustrations are taken from Choulant, pp. 69 and 71. The crudeness of these drawings is self-evident, and it would be difficult for the modern mind to conceive what amount of anatomy, — general, topographical or surgical — could be gained from them.

any event, one can but admire this man for his diligence and the accomplishment in the making of the Tabulae Anatomicae.

Illustrations of accurate anatomical studies are of but recent date, certainly not over 400 years. If comparison is made of the Eustachian, Vesalian, Fallopian and other contemporary anatomical works, with those of previous decades, one may easily understand the status of surgery and medicine of that period (Fig. 14).

Fallopius, Vesalius and Eustachius should be considered an immortal triad, whose life work was of such force that they reformed the study of anatomy into factual and accurate

channels by repeated dissections. The previous anatomical descriptions and the few illustrations, when compared, revealed, in most instances, gross inaccuracies. The acme of their fame culminated in their ability to preserve their dissections and studies by illustrations in wood cuts and copper engravings.

When one considers the many, and, at times, the almost insurmountable difficulties imposed on teachers and students of anatomy of 400 years ago, the marvel is, — how well they accomplished what must be considered, even today, as masterpieces of illustration and fundamentally accurate anatomy.

Thanks and acknowledgment for the many courtesies extended to me are hereby made to Dr. Archibald Malloch, Librarian of the New York Academy of Medicine, and also to Miss G. L. Annan, of the Rare Book Department of the Library.

ADDENDA.[21]

Inasmuch as mention has been made of Andreas Vesalius, it would be a very fitting tribute to him and to Nicholas Copernicus to recall at this time that this year the scientific world is celebrating the four hundredth anniversary of the publication of two books, — one the "De Revolutionibus Orbium Coelestium" (concerning the Revolutions of the Heavenly Bodies) by Nicholas Copernicus, and the "De Fabrica Humani Corporis" (The Structure of the Human Body) by Andreas Vesalius. Both of these books and authors, as it were, paralleled each other in that they refuted the ideas of two other early scientists, — Claudius Ptolmaeus (Ptolemy) in his "Almajest," and Claudius Galenus (Galen) in his "Of the Anatomical Administration" and "Of the Use of the Parts of the Human Body," both of them living during the second century A. D. In the first instance, the theory of Ptolemy, — that the Earth was the center of the Universe, — was shown to be incorrect by Copernicus in that he demonstrated that the center of our system was the Sun. Vesalius showed that the anatomical writings of Galen, which were accepted for 1,400 years, were, in many instances, dissections of animals and that many of the details and even the gross descriptions

of the body, were incorrect or that they had been missed entirely.

Vesalius was a Belgian and Professor at the University of Padua 30 years after Copernicus, a Pole, studied there as a medical student.

The two works mentioned here were the Magnum Opus of each man, — one the "De Fabrica," being published when Vesalius was 28 years old and the other the "Revolutionibus" published when Copernicus was 71 and on his death bed. Copernicus showed the world that the Earth was but a small member in the planetary system, which, in itself, was but a very small item in the Universe of the Stars. Vesalius, by his dissections and accurate representations of them in the "De Fabrica," corrected the many errors in the anatomical writings and publishings that preceded him. He showed that it was necessary, in order to understand anatomy properly, to actually dissect the body rather than attempt to familiarize oneself by the study of pictures and drawings, many of which were inaccurate.

Both men were persecuted by their professional colleagues because of their theories. Both of their works, "De Fabrica" and "De Revolutionibus," remain, after four centuries, masterpieces in their particular fields. Their authors were the founders, respectively, of modern anatomy and astronomy and astrometry.

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THERAPY OF DEAFNESS.

PART IV — REPORT OF CASES.*

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In the previous divisions of this article were presented records of children of 13 and younger. That the removal of adenoid tissue may improve hearing presents no basis for controversy; but that long-continued deafness in adults can be ameliorated is disbelieved by most otologists. It is hoped that the following pages will alter this attitude.

Treatment of deafness should not be based alone upon a standardized diagnosis but should evolve from the envisioning of all possible aberrations: organic, biochemical and psychic.

Diagnosis of ear disease, as concerned with deafness, was all "settled" years ago. Deafness is either conductive, perceptive or mixed. Conduction deafness is usually due to post-suppurative or "catarrhal" fibrosis of the tympanum, or to otosclerosis. Perceptive deafness is due to atrophy of Rosenthal's ganglion and other neural elements from toxemias, exposure to loud noise, senility, etc. Tinnitus is either tubal, tympanal, labyrinthine or central. Fortunately, we have awakened to the disconcerting fact that many cases of deafness do not fit well into the above categories. High tone loss, once considered pathognomonic of neural involvement, is often due to tubotympanal pathology. Otosclerosis is not always classical conduction deafness; in fact, in the majority of cases there is end-organ nerve involvement and also cerebral factors of great importance. Tympanal fibrosis of long-standing becomes complicated with cerebral factors and often with neural degeneration. Many lengthy papers have been written on tinnitus and its treatment but we still know but little about tinnitus.

Disuse of the central mechanism of hearing must result in alterations within the cerebral centers (dimming of speech

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patterns, etc.). Pathology as we know it is mainly dead pathology which presents not only a warped, stained cellular picture but almost totally misses the biochemical changes which are going on during life.

It seems to me that clinically it would be well to forget the nice, simple categories of aural disease that we inherited and begin to think of the hearing apparatus as a whole — end-organ; VIIIth nerve and its central pathways; brain centers; then to think in terms of reversible and irreversible pathology, biochemical potentialities and psychosomatic phenomena.

When cerumen becomes impacted it may cause deafness. The condition is easily reversible.

Adult tympanal fibrosis is irreversible regardless of cause, but there are often other factors present in deafness from tympanal fibrosis which can be altered. These may include neural degenerative changes in the cochlea, deficiency alterations in cerebral metabolism, weakened cerebral speech patterns, etc.

In otosclerosis there are multitude factors, some of which have been given scant attention. We visualize a focus of dystrophic bone anterior to the oval window progressively encroaching upon the footplate of the stapes with final complete ankylosis. If this were all, we would always have normal bone conduction and a greater loss for low tones than for high. In my experience this type is seen far less frequently than the type with equal loss of low and high tones or with greater high tone loss. Do these cases represent a coincidence of nerve deafness and otosclerosis, or is the neuropathy an essential part of the picture of otosclerosis? A focus at the internal meatus could cause the neural involvement through direct pressure upon the ramus cochlearis and through interference with circulation. Some specimens with a focus at the round window show an encroachment of the dystrophic bone upon the spiral ligament which could, through altering the tension of the basilar membrane, produce a change in cochlear function. Are there other organic factors? We don't know.

Thus far, then, there are three factors: A spreading focus of dystrophic bone, neural degeneration and cerebral altera-

tions (dimming of speech patterns, etc.). The dystrophic bone of otosclerosis is surrounded by an area of preparedness — decalcification. As this halisteresis increases, osteogenic marrow grows out from the focus and new bone of the dystrophic type is deposited; thus the focus increases in size. There is no known way of causing the dystrophic bone to disappear but there is clinical and experimental evidence that decalcification can be inhibited with a diet adequate in calcium, phosphorus and vitamins.[1]

The possibility of altering the neuropathy of otosclerosis will be discussed later, with nerve deafness from other causes.

As impairment increases, otosclerotics tend to withdraw from social contact which depresses them. The memory of speech patterns is dimmed, and as this increases, comprehension decreases. There is another factor and a vicious one: As the impairment progresses some otosclerotics become more and more introspective and depressed; discontents, suspicions, projected personal aggressions become intensified; vague fears on the part of female otosclerotics that they can no longer compete with their normally hearing female acquaintances may lead to unjustified jealousy. In some cases this state of mind may convert the malady into a weapon of defense — an unconscious plea for sympathy in order to hold the mate. This unconscious motivation may cause such a patient to refuse to wear a hearing aid, study speech reading or undertake any form of treatment. In such cases the psychoanalytic approach is indicated.

Central factors accompanying otosclerosis and other forms of deafness often can be altered by the correct approach. In the past, deafness, being looked upon as purely an end-organ disease, was treated with various local measures, including inflation, operations on the drum membrane, injection of thyroxin into the tympanum, etc.; this, because no serious consideration was given to the differentiation of reversible from irreversible pathology.

In our daily testing of hearing we have been given leads as to the accessibility of central factors in deafness. The marked variations noted in fatigue states, during menstruation, in nervous individuals, etc., have been reported frequently. These variations in hearing are surely not due to

changes in the cochlea but are central in nature, and, since variable, the underlying cause should be amenable to treatment.

That the diets of American people are far from correct is the consensus of opinion among all nutritionists.

Americans consume far too much sugar and white flour products and far too little of vegetables and fruits. Calcium, iodine, B complex vitamins, vitamin D and iron are almost universally deficient. Acid-base ratio in diets usually shows a marked excess of acid-producing foods. Secondary anemias are far more common than are recognized. The supplying of the above deficiencies over a sufficient length of time will improve general health and with this improvement comes decreased fatigability, greater alertness and often improvement in hearing.

An extremely important aspect of treatment through diet and vitamins is the question of proper utilization of vitamins. After an initial two months of vitamin injection, most patients carry on very well with maintenance doses by mouth; some are never able properly to utilize orally administered vitamins. Absorption from the intestine may not occur, vitamins may be destroyed en route, laxatives may eliminate vitamins before absorption can take place, elimination in urine may be too rapid, etc. Raw egg and mineral oil interfere seriously with vitamin utilization. Patients sometimes take everything prescribed at one time in order not to be bothered the rest of the day. The result is rapid elimination of a large part of the intake. It is well known that in acute illnesses, in pregnancy, in periods of unusual stress there is an enormous increase in the requirement of vitamins. Individual tolerance is another factor of importance. Not infrequently patients are found to be allergic to thiamin and will break out in hives from relatively small doses. Some are hypersensitive to niacin. Dicalcium phosphate may cause nausea and gastric pain. With the multitude of preparations on the market there is no difficulty in finding a substitute for one that disagrees. Generally speaking, I believe natural vitamins are more effective than synthetic ones, although I prescribe the latter for various reasons. Example — the natural rice bran B complex syrups are better than tablets of

thiamin, riboflavin, niacin. Natural vitamin D is better than viosterol. The best form of calcium is dicalcium phosphate powder in hot water, but when this disagrees, the flavored tablets may be substituted. Sometimes dicalcium phosphate mixed with cottage cheese is well tolerated where it cannot be taken in hot water. Brewer's yeast is an extremely valuable source of B complex but many patients dislike the odor and taste of the powder and refuse it. Tablets of yeast may then be given. I prefer to prescribe the brewer's yeast powder in water or tomato juice. Occasionally children who refuse it will eat it with relish when a sandwich of brewer's yeast powder and peanut butter plus catsup is offered.

Of great importance in the treatment of impaired hearing is a complete understanding by the patient of the program to be undertaken. Some people come in with the illusion that their problem will be solved in a few weeks or even less. If it is explained at the beginning that the program is one of months or years and not weeks; that the items prescribed are not really medicines but foods which must become part of life's routine, much dissatisfaction will be avoided.

After a few weeks of improved diet and vitamin therapy the feeling of well-being is usually so pronounced that there is little difficulty then in procuring full co-operation.

In connection with the question of cerebral hearing (comprehension through well established speech patterns) there have appeared recently a number of papers.[2,3,4] Whereas formerly the audiometer was accepted as the sole means of accurately testing hearing, there is an ever increasing realization that hearing is something more than sensing pure tones. It has long been recognized that one cannot always judge from an audiogram how much the individual can hear. Some have astonishingly good hearing for speech with low audiograms while others with very moderate audiometric impairment have marked impairment for speech. Since I believe that hearing pure audiometric tones is a different thing from hearing speech, I wonder if it isn't impossible to ever deduce from an audiogram what the percentage of speech loss really is. Fowler[5] states, "At first thought it might appear that the simplest standard would be to use a definite volume of speech and to measure the distance it is heard. But the problem is not so simple as this, because it is difficult to speak

at a given intensity using natural speech, and artificial speech such as that from a phonograph is not usable except as a rough gauge." When residual air is used and the tests are made in the same place (a quiet room) it has been my experience that the accuracy is astonishing when one considers the complexity of speech sounds and how these complexities vary with different types of sentences, — (sibilants predominating, nonsibilants predominating, simple, easily understood sentences dealing with the concrete — complicated sentences dealing with the abstract, etc.). I have repeated such tests using different sentences and found the variation rarely more than 12 inches for whispered voice and often only one or two inches. We must also remember that everyone is interested in how much he can hear throughout his daily contacts which include all degrees of extraneous noise and all types of speech enunciation and intensity. A court is no more interested than is the individual in what degree of hearing loss exists in a soundproof room with an audiometer or in an attempt to evaluate hearing of all kinds of speech under all conditions from the results of pure tone testing. The court and the individual are interested in the degree of hearing in everyday experiences. I think Fowler[5] gives an excellent reason for not even attempting to utilize the audiogram in figuring the percentage of loss when he states: "The main difficulty in setting up a standard for measuring the capacity to hear speech lies in the fact that speech is made up of many varying combinations of frequencies, consisting of broad and narrow frequency bands, all of which differ in intensity and importance under different conditions of production and reception. If a man is accustomed to hearing conversational speech, with a great or total loss of hearing for some frequencies, all the frequencies he does hear assume a different importance than they do for a normal person."

Testing the hearing of speech through a microphone attached to an audiometer and with an intensity gauge has great possibilities. I have not had sufficient experience with this technique to report upon it. As I have stated before, hearing of speech is in reality the awakening of patterns stored in the higher psychical centers. This explains why an intelligent alert individual will comprehend when hearing only two or three words of a sentence, whereas an unintelligent

person may not comprehend although hearing all but two or three words of a sentence. There are a multitude of psychic, attentional concentration factors which are involved in hearing that determine varying percentages of hearing loss under different conditions.

NEURAL REGENERATION.

Where neuropathy is the cause of deafness and audiometric improvement occurs, one is justified in assuming that regeneration within the end-organ has occurred. Where hearing for speech improves and the audiogram remains unchanged the improvement is due to alteration within the central mechanism. Dietary regulation and vitamin therapy can increase the ability of the brain to hear and comprehend speech. There is clinical evidence that neural regeneration within the end-organ can result from adequate therapy.

Jones[6] states, "We already are sure that no vitamin can be expected to improve any condition that has not been caused by a lack of the same vitamin." With this I disagree. I believe that regardless of etiologic factor, the regeneration of nerve tissue through vitamin therapy is a possibility as long as the change within the involved nerve and ganglion has not reached the stage of granular disintegration. The earliest changes are cloudy swelling and spotty degeneration of neurilemma; then follows loss of myelin sheaths and finally granular disintegration of axis cylinders. In some cases all these changes occur simultaneously.

The question has been asked, "Why, if vitamin deficiency can cause deafness, does not the pellagrin and sufferer from beriberi show impaired hearing?" The answer is that nobody has reported testing the hearing of such patients. In a series of pellagrins reported by Spies, *et al.*,[7] the symptoms vertigo and tinnitus were present in a number of cases. This would seem to indicate aural involvement, but unfortunately no hearing tests were made. Peripheral nerves were removed from the pellagrins and from normal control subjects. In eight of the 10 pellagrins the myelin sheaths were reduced in number; the axis cylinders were found involved in the same severity as the myelin sheaths. In the control subjects the nerve bundles contained 6,500 to 9,000 myelin sheaths per square millimeter. In the deficiency cases the nerve bundles rarely contained as many as 5,500 sheaths. A number of large myelin

sheaths measuring up to 15 microns were found in patients with moderate and severe neuritis. In the normals it was rare to find myelin sheaths of 12 microns. In one case, age 21, there were found in the terminal portion of the anterior tibial nerve only 380 myelin sheaths to the square millimeter.

There have been many reports in the literature of failure to improve hearing with vitamin therapy. In all cases the basis for conclusion was testing solely with the audiometer. Since audiometry is not a test for hearing but solely a means of measuring cochlear and primary hearing center function, voice tests may have given a different result. In none of the reported cases was vitamin therapy continued for an adequate length of time and in none was mention made of any attempt to regulate diet. It has been emphasized repeatedly by nutritionists that rarely does a single vitamin deficiency exist; therefore, administering thiamin hydrochloride alone or niacin alone without determining other possible deficiencies through diet analysis would give little chance of improvement. Covell[8] states, "Our greatest need is to come to recognize physical signs which accompany mild or moderate grades of a dietary deficiency. This is not an easy task since it is highly probable that the diet of an individual shown to be deficient in one factor may also be lacking in other related vitamins. For example, to prescribe vitamin B_1 for nerve deafness without first ascertaining the possible relationship of the hearing impairment to a dietary deficiency will lead only to discouraging results."

In previous articles by Covell[9,10] experimental vitamin deficiences were shown to produce degeneration of the cochlear nerve. In his report dealing with histopathologic changes in the peripheral auditory mechanism for avitaminoses A, B_1, B_2, B_6, filtrate factor (antigray hair factor and chick antidermatitis factor), C, D, and E, Covell[8] studied the animals not only for the characteristic manifestations of deficiency but also for evidences of repair from subsequent feeding with the lacking vitamin. Deficiency in B_6 caused a dermatitis of the external ear. The incidence of middle ear infection in the deficiency rats was considerably higher than in the controls. The incidence of infection in avitaminoses B_1, B_2 and B_6 was reduced by the administration of the missing factor.

With avitaminosis A there was keratinization and meta-

plasia of the epithelium of the tympanum. In vitamin C deficient guinea pigs there occurred hemorrhage into the submucosa of the tympanum with fibroblastic proliferation and sloughing of the epithelium. The muscles of the middle ear showed degenerative changes in vitamin E deficiency. Periosteal thickening in the ossicular chain occurred in A and E deficiencies. In A deficiency there was an actual increase in thickness of the periosteal bone. In D deficiency the ossicles showed osteoid tissue which was also seen in the periosteal and enchondral layers of the otic capsule. The annular ligament of the stapes was not found involved in any of the animals. Degenerative changes in the membranous cochlea were never extreme. Alterations of mild degree were found in the various specialized cells of the cochlear duct. These changes, not found in any of the control animals, Covell considers as possible etiologic factors in deafness. In B_2 deficiency were found moderate degenerative changes in the external hair cells. In some of these cases there was hemorrhage into the scala tympani.

In vitamin C deficient animals the Corti cells were swollen. In filtrate factor, B_6 and A deficient animals, the cells of Deiter, Claudius and Hensen showed varying degrees of degeneration. In all the deficiencies the external sulcus cells showed mild to moderate changes. In C cases the changes were marked. In A cases the stria vascularis was swollen and the cells degenerated. C cases showed less obvious alterations. In the C cases the spiral ligament was frequently found partially separated from the inner bony wall of the cochlea. Reissner's membrane was often ruptured. There appeared to be increased endolymphatic pressure over the control cases.

The spiral ganglion cells were affected in all cases; more in B_2 animals, less for B_1 and the filtrate factor and considerably less for A and B_6.

Of the utmost importance is Covell's statement that the appearance of the spiral ganglion cells was considerably improved for those animals which received the missing factors after being made deficient in B_1, B_2, B_6 and the filtrate factor. A comparative count of the cells was not made but Covell believes it possible that a longer period of deficiency would have resulted in the disappearance of large numbers of ganglion cells.

Susceptibility of the cochlear nerve to myelin loss was shown by Covell[9] in experiments with quinine, sodium salicylate and staphylococcus toxin. The degenerative changes in the hearing nerve were greater than in other cranial nerves, including the vestibular.

In all the deficiency animals Covell noted demyelinization of the distal portion of the cochlear nerve. The greatest change was found in B complex deficient animals. Covell concludes with the statement: "These studies confirm, in general, the findings of Mellanby,[11] Ono,[12] Loch[13] and others on the effects of various avitaminoses on the peripheral auditory mechanism. Emphasis has been laid upon the deficiencies included under the vitamin B group. Many of these have a common source in nature, such as the wheat germ. Our dietary is low in the latter because of the extent to which our cereals and flours are refined. It is in fact probable that the average human being is low in B vitamins. Since these vitamins have been shown to be essential for the maintenance of the functions of the central and peripheral nervous systems, certain cases of nerve deafness may well be due to their lack. As a rule it will more probably meet the need to prescribe concentrates of the whole vitamin B group rather than a single factor.

"Attempts have not yet been made to study the auditory pathways in the central nervous system either for the effects of drugs, toxins, chemicals or dietary deficiencies. Many of these agents are known to produce lesions elsewhere in the central nervous system. Because of its complexities the central auditory mechanism is unexplored from this standpoint and it is not possible to speculate on the importance which vitamins or other factors might have in maintaining its integrity. In other words, to credit the changes in the peripheral auditory mechanism produced by these agents with all the impairments of hearing is erroneous. The story is only half told from experimental studies involving the middle and internal ears and the peripheral nerve."

The question now presents itself — are the diets of most people in our prosperous country adequate in the various essential factors[14] including vitamins A, C, D and B complex?

To quote W. H. Sebrell, Senior Surgeon of the United States Public Health Service; Chief, Division of Chemotherapy,

National Institute of Health: "The prevention of malnutrition and the deficiency diseases is probably the greatest and most complex problem in public health that this country has ever had. The exact extent of physical disability, economic loss and disease directly or indirectly related to nutrition are unknown, and yet there is every indication that malnutrition is very widespread. Some physicians who do not see many cases of advanced deficiency disease feel that the importance of nutrition is being overemphasized. However, in every clinic in which close observations are made and the more refined methods of diagnosis used, many unsuspected cases of malnutrition are recognized, and every study reveals the importance of mild degrees of deficiency in producing symptoms the cause of which was hitherto unrecognized. Furthermore, it is significant that almost all practicing physicians are prescribing vitamin preparations for more and more of their patients.

"Even before our food supply was disturbed by the conditions incident to the war, a number of surveys had all shown that a large part of our population was eating foods which failed to provide the essentials in amounts recommended for optimum nutrition. For example, a survey of the diets of more than a thousand workers in a large aircraft factory revealed that more than four-fifths of the diets studied fell below the amounts of certain nutrients recommended by the Food and Nutrition Board of National Research Council. Nutritionists who have watched workers select their lunches in cafeterias report that not more than half of them choose good lunches even when foods needed to provide good lunches are on the counters. It was also observed that women usually made poorer choices than men. The method of food preparation also greatly affects its food value. In a study of food as it was served it was shown that as much as 90 per cent of the thiamine (B_1) present in the fresh raw food was lost before the food was eaten. Keeping food hot for long periods of time is really overcooking it, and the vitamins destroyed by heat and oxidation are thus lost. The hot lunch prepared and kept hot for hours before consumption may not be as satisfactory nutritionally as a cold one.

"The effect of such inadequate diets on the ability of the civilian worker to do his part in the war effort must be of serious concern to us at this time. As a nation we are not as

well fed as we once believed. Physicians and health officers must recognize that here is a whole new sphere of responsibility in the field of preventive medicine as great as or greater than the field of sanitation or control of communicable diseases."

The nutritionists have been proclaiming for quite some time that the American diet includes a horrifying amount of white flour products and refined sugar; that universally there is a deficiency in B complex and vitamin D. Physicians don't believe this, else more of them would be interested in diet analysis instead of handing out typewritten forms to their patients: diet *1.* for constipation, *2.* for obesity, etc.

In a recent discussion of diet, a prominent internist impatiently said, "I get so tired of hearing about dietary deficiencies. The American people all eat well. You can't go wrong. Even at the lunch counter of a drug store a well balanced diet is put before you." In the same vein, Childrey[15] writes, "One suspects that the average adult diet, even in those with nerve deafness, contains an adequate supply of this vitamin (vitamin B) which is fairly widely distributed, for when questioned concerning a list of foods containing this substance, most patients are sure of no lack of it."

Asking what a patient eats is unsatisfactory because it lacks accuracy. We want to know what is consumed over a period of seven days; amounts, how prepared, etc. We must keep in mind that all of vitamin C, 25 per cent of A and 50 per cent of B is destroyed by cooking.

If the doctors who believe our diets are adequate and who are satisfied with asking their patients if they get enough of this, that or the other food would take the time to analyze, scientifically, a carefully recorded seven-day diet, they would learn that only a small percentage of our population partake of anything resembling an adequate diet.

For six years I have either analyzed the diet of every case of impaired hearing or had the analysis made by Dr. Michael Walsh, of San Diego. Only one diet in these six years has been found correct and that was in the case of an individual whose diet had been supervised previously by a nutritionist and who had adhered to it for years. All other diets have been defi-

cient in B complex and vitamin D, with deficiencies in other factors varying with each case. There is no royal road to determining the correctness of diet. Asking patients what they eat is woefully unsatisfactory. In the seven-day recording, everything that passes the lips is written in. This includes food at meal time and in between, alcoholics, medicines and water. Also recorded are weight, height, type of work, exercise, amount of sleep, frequency and type of bowel movement, etc.

TECHNIQUE.

Much time is spent in taking the history. We wish to know the degree of impairment; under what conditions the patient has difficulty in understanding speech, etc. Has there ever been any vertigo? If tinnitus is present, what is the exact type? Is it heard constantly or only in quiet places? All diseases of the past should be recorded, particularly the occurrence of otitis media; whether there has been a head injury with bleeding from ears; unconsciousness. Has the patient ever gone hunting or been exposed otherwise to loud noises? Have quinine or salicylates ever been taken? Is hearing better in noisy places? Wassermann made? Have any X-rays been made? Has patient been a swimmer — diver? Is there a variation in hearing? Condition of general health. Constipation? Has mineral oil been taken? Does the patient eat raw egg? If there are children—how is their hearing? Cases of impaired hearing in family? While taking the history one notes the degree of intelligence, stability of nervous system, etc.

Next, a careful physical examination of the nose, throat and ears is made. With an electric Siegle otoscope the mobility of the drum membrane and malleus is determined. It is interesting how frequently the hearing is more impaired on the side of nasal obstruction from a deviated septum, etc. It is important to note the exact condition of the teeth. Calcium-D deficiency is often reflected in chalk deposits and degree of caries. Inflation with catheter to determine patency of Eustachian tubes.

The patient is weighed and measured for height and given a diet form for recording a seven-day intake.

At the next visit air audiometry is done in a soundproof room and tuning fork tests made. Next, bone conduction audiometry is done. Careful masking is used when indicated. At subsequent visits the air and bone audiometry are repeated and hearing aid tests made. Vestibular tests (no caloric routinely).

Finally voice tests as follows: both ears open; from the rear, sibilant and nonsibilant numbers and sentences are given with residual air. The distance is measured with a tape. Next, each ear is masked by scratching paper while numbers and sentences are tried on the opposite side. Both whispered and conversational voice are used.

After the completion of all tests the findings are studied, a summary made and treatment outlined. A written report concerning dietary changes, medication, lipreading, hearing aid, etc., is given to the patient.

Abnormalities of the nose and throat should be corrected where possible. Chronic tonsillitis, sinusitis and dental infections may be very intimately related to the hearing impairment.

Supplemental vitamins, calcium, phosphorus, etc., are given as indicated.

In all cases a natural B complex concentrate made from rice bran is prescribed. Ten thousand units of vitamin A in combination with vitamin D. All patients are required to drink orange or grapefruit juice and the juice of one-half lemon daily. At least two glassfuls of whole or skimmed sweet milk or buttermilk. Some form of cheese and a large raw vegetable salad (at least six different vegetables) at noon.

Office treatment is given twice weekly for about two months. Intramuscular injection of eight to 16,000 units of thiamin hydrochloride and five to 10 units of plain insulin subcutaneously are first administered. Before the injection, each ear is exposed to infra-red heat for five minutes. Next, to the external auditory canals, are applied first 95 per cent alcohol and then a boric acid ointment. The heat and the applications are used for several reasons. In many cases of

chronic impairment there is itching from lack of cerumen (particularly in otosclerosis). Theoretically the hyperemia from the heat and the gentle massage of the canals may result in a larger amount of the injected vitamin reaching the ears. I have seen a definite increase of cerumen in some otosclerotics which may have resulted from the local treatment. Finally, if something is being done to the ears the patient is much more satisfied and is more willing to co-operate in all the other measures employed.

The effect of the treatment upon general health and hearing is observed, and audiometry and voice tests are repeated from time to time.

Following a series of thiamin injections, niacin is used in dosage from 25 to 50 mgm., also with five to 10 units of insulin.

Finally liver concentrate (7½ to 15 units) injections are given.

After the injections have been completed the patient continues to follow his diet, plus the supplemental oral vitamin therapy. At certain intervals thereafter hearing tests are repeated. In some cases additional series of injections are given.

Among the outstanding general improvements noted are: *1.* decreased fatigability; *2.* cure of constipation; *3.* increased appetite; *4.* gain in weight; *5.* relief of nervousness; *6.* increased strength of nails; *7.* clearer skin; *8.* improved cerebration.

Concerning the rationale of thiamin, niacin, insulin and liver therapy: thiamin and niacin, the so-called antineuritic vitamins, are essential to neural integrity. Most diets are lacking in B complex; therefore, it is logical to believe that in addition to other etiologic factors in deafness, this deficiency often plays a rôle both because of its effect on the peripheral hearing mechanism and the central ramifications of the VIIIth nerve. Thiamin is normally an essential component of nerve tissue. When this element is dissipated either thru B deficiency in diet or through an increased liberation of thiamin from the storehouse liver, neural degeneration begins. During pregnancy and acute illness there is a

great increase in the need for B complex. It is particularly at such times that neural damage is apt to occur. Fortunately cloudy swelling of neurilemma and myelin sheaths may continue for long periods without irreversible damage occurring. These are the cases in which regeneration may be accomplished. After granular disintegration of axis cylinders and disappearance of ganglion cells have occurred there is no possibility of improvement.

We know that in niacin deficiency (pellagra[7]) there is both swelling of myeline sheaths and decrease in their number; therefore, it is logical to believe that even in subclinical deficiency of this B complex factor, changes in the end-organ which would benefit by niacin therapy are probably present.

Both thiamin and insulin are concerned with carbohydrate metabolism; in fact both are indispensable.

It has been known for a long time that even in nondiabetics the administration of small doses of insulin will increase the appetite and weight and produce a feeling of well-being in many underweight, fatigued individuals. I have used the thiamin and niacin injections without insulin and with it and believe that particularly in the case of thiamin the efficacy is increased when combined with insulin therapy. An occasional patient will not tolerate insulin. It produces a "shaky" feeling, weakness, sweating and general malaise. When this occurs with a five-unit injection, insulin should not be given. Most patients tolerate even 10 units without reaction. It is important to have candy in the office and that each insulin patient be given one or two pieces to eat 20 minutes after injection.

Liver injections are given because of their tonic effect and B complex and iron content. When, after the first series of injections, a patient's progress is satisfactory the injections need not be repeated. If progress is not satisfactory on oral therapy alone, the series of injections should be repeated after intervals of two to three months.

Case 1: M. G., female, age 20. Feb. 26, 1942.

Impaired hearing 1½ years, tinnitus, "blunt" sensation in right ear. Increasing difficulty in hearing employer dictate letters, understanding people who come into office and in hearing over the telephone. Very

sensitive to air currents. Appetite poor, marked fatigability. Acute purulent otitis media at three. Family history negative for deafness.

Mouth: Many fillings, two devitalized teeth removed one year ago.

Fauces: Tonsillectomy and adenoidectomy at 11 years. Lymphoid recurrence — removed with electrocoagulation.

Nasopharynx: Negative.

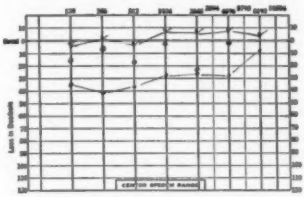
Nose: Epistaxis from ectatic vessels on septum. Septum deviated to left; otherwise negative.

Drum membranes: Right, retracted; mobility of malleus impaired; left, retracted; mobility of malleus normal. Slight impairment of tubal patency on both sides.

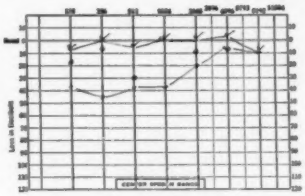
After-Turning Nystagmus: Right, 36 seconds; left, 31 seconds.

Whispered voice heard normally on both sides.

Audiometry, Feb. 26, 1942, showed a speech range loss of 35 average, with a slightly lower dip on the left.



Case 1. M. G. Age 20. Right ear.
Air conduction 2/26/42 •
8/ 2/43 ✓
Bone conduction 2/26/42 o



Case 1. M. G. Age 20. Left ear.
Air conduction 2/26/42 •
8/ 2/43 ✓
Bone conduction 2/26/42 o

Treatment: Diet regulated. Prescribed one capsule of oleum percomorphum daily; Galen B (rice bran concentrate), two teaspoonfuls daily; dicalcium phosphate, one heaping teaspoonful in hot water upon arising. Intramuscular injection of 8,000 units of thiamin hydrochloride and subcutaneous injection insulin, five units were given twice weekly.

After the third injection patient developed hives. On March 19, 1942, injection (intramuscular) of niacin mg. 25 and insulin five units was started. On March 20, 1942, endurance and appetite improved. A total of 11 injections of niacin and insulin were given. On April 10, 1942, tinnitus had decreased. There was a feeling of well-being and marked increase in endurance. The "blunt" feeling in right ear had disappeared. On June 22, 1942: "I hear three times as well as before." On Sept. 14, 1942: Hears normally over the phone and has no difficulty hearing people in the office. Marked increase in energy. On Aug. 2, 1943, patient stated her hearing was perfect.

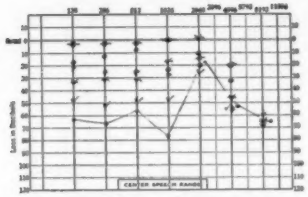
Audiometry: Normal hearing.

Comment: The drum membrane picture, first audiometry and history of otitis media suggest a conduction deafness due to postsuppurative fibrosis. Against this was the normal whispered voice test. The prompt improvement in general health and the subjective sensation of improved hearing and the final normal audiometry one year and five months after improved diet and supplemental vitamin therapy was instituted speak against end-organ pathology and for a cerebral factor alone; however, with normal end-organs and subnormal cerebral metabolism one would

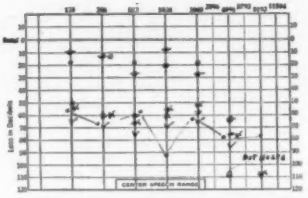
expect a normal audiogram with impaired voice perception. This patient had difficulty understanding speech in her everyday life and showed audiometric loss but gave a normal whispered voice test. The patient is happy with the result even though a diagnosis has never been made.

Case 2: G. W., female, age 37. May 9, 1941.

Following pneumonia in 1930, impairment of hearing was manifested. Tinnitus, left ear only, until tonsillectomy in 1934, after which both ears were affected. Paracusis Willisii negative. Wassermann negative. B. M. R, minus 15. O. M. P. A. in childhood. One brother, impaired hearing since childhood. Nose and throat negative. Drum membrane, right atrophic, malleus fixed. Drum membrane, left, negative in appear-



Case 2. G. W. Age 37. Right ear.
Air conduction 5/ 9/41
7/18/41
9/22/42
3/ 4/43
Bone conduction 5/ 9/41
9/23/42



Case 2. G. W. Age 37. Left ear.
Air conduction 5/ 9/41
7/18/41
9/22/42
3/ 4/43
Bone conduction 5/ 9/41
9/23/42

ance but with moderate impairment of mobility of membrane and malleus. Eustachian tubes patent. Forks: Weber lateralizes to left. Rinne negative, right and left. Schwabach normal. C64 not heard. Voice test — whispered — with masking.

		Sibilant Nos.	Nonsibilant Nos.	Sentences
Right ear	5/ 9/41	9 ft., 7 in.	8 ft.	1 ft., 8 in.
	11/22/41	15 ft., 5 in.	20 ft.	14 ft., 9 in.
	4/ 6/42	20 ft.	20 ft.	20 ft.
Left ear	5/ 9/41	1 in.	1 ft.	0
	11/22/41	1 in.	2 ft.	5 in.
	4/ 6/42	4 ft., 7 in.	7 ft., 8 in.	2 ft.

Diagnosis: Conduction deafness plus neuropathy as manifested by the high tone loss for bone conduction and by the air conduction drop below 50 dcb. Pathology — bilateral tympanal fibrosis resulting from otitis media. The neural involvement seems to have resulted from the pneumonia.

Treatment: Dietary regulation thyroid gr. ½, one capsule of oleum percomorphum daily, one heaping teaspoonful of dicalcium phosphate in hot water upon arising, two teaspoonfuls brewer's yeast powder, two niacin tablets mgm. 25, two thiamin hydrochloride tablets mgm. 5, one riboflavin tablet mgm. 1, lactose one tablespoonful daily (used in milk or coffee). The B_1 niacin and riboflavin were later alternated with Galen B (rice polishings concentrate).

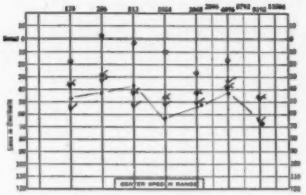
On Sept. 22, 1942, tinnitus was still marked when patient was fatigued. Believes her hearing has improved very much; has more endurance. General health markedly improved.

Audiometrically the right ear showed a steady improvement up to Sept. 22, 1942, while the left ear remained essentially the same.

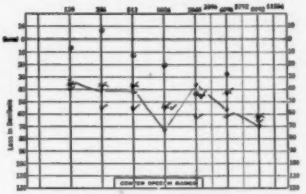
Comment: Certainly the tympanal pathology was unaffected. Neural regeneration and improved cerebral perception seem to explain the changes which occurred.

Case 3: July 3, 1941. S. A., female, age 34.

Impaired hearing noted at age 17. Paracusis Willisii positive. After birth of child hearing became worse. Very nervous. Marked fatigability. Secondary anemia for years. Three years ago received quinine to produce an abortion. No otitis media purulenta but had frequent earache. Several years ago received a head injury — unconscious — no bleeding from ears. From age 13 on, went hunting three times weekly. Measles at 16. Family History: A paternal and a maternal aunt deaf. One brother deaf. Nose and throat negative. External auditory canals large. Cerumen present. Right drum membrane retracted. Mobility of membrane and malleus impaired. Some tubal obstruction. Left drum membrane negative with impaired mobility of malleus. Tube patent. Vaso-



Case 3. S. A. Age 34. Right ear.
Air conduction 7/ 4/41 ●
11/21/41 ✓
8/20/43 ✗
Bone conduction 7/ 4/41 ○



Case 3. S. A. Age 34. Left ear.
Air conduction 7/ 4/41 ●
11/21/41 ✓
8/20/43 ✗
Bone conduction 7/ 4/41 ○

motor reaction, left, normal; less reaction on right. Tinnitus present. Forks: Weber not lateralized. Rinne negative, right and left. Schwabach normal. Normal after-turning nystagmus.

Voice Test: From rear, both ears open.

		Sibilant Nos.	Nonsibilant Nos.	Sentences
7/ 3/41	Conversation Voice	16 in.	5 in.	6 in.
11/21/41	Conversation Voice	8 ft., 9 in.	7 ft., 2 in.	3 ft., 2 in.
7/ 3/41	Whispered Voice	0	0	0
11/21/41	Whispered Voice	2 ft., 3 in.	8 in.	0

Whispered voice with masking.

7/ 3/41	Right	1 in.	1 in.	0
11/21/41	Right	5 ft., 4 in.	1 ft., 8 in.	7 in.
7/ 3/41	Left	3 in.	1 in.	1 in.
11/21/41	Left	1 ft., 2 in.	10 in.	7 in.

Audiometry: Fairly symmetric air and bone curves.

Diagnosis: Otosclerosis plus tympanal fibrosis.

Treatment: Lip-reading and hearing aid. Diet analysis by Michael Walsh, of San Diego. It was found that protein, carbohydrate, calcium, phosphorus, iron, iodine and all vitamins were deficient. A diet with correction of all deficiencies was given. Prescribed three dical D tablets, one oleum percomorphum capsule, two measures of ryzamin B No. 2, two 5 mgm. tablets of thiamine hydrochloride, two 25 mgm. tablets of niacin, one 1 mgm. tablet riboflavin, three cofron (iron and liver concentrate)

capsules, five drops Lugol's sol. t.i.d. Intramuscular injections of 16,000 units thiamin hydrochloride twice weekly. The ryzamine B No. 2 was later changed to Galen B (rice bran B complex concentrate). On Nov. 21, 1941, tinnitus had discontinued but later reappeared in a much milder form after an attack of flu.

On March 31, 1942, anemia unimproved. Urged to consult an internist. Can now hear telephone ring from living room, which she could not hear previously. Is less nervous. Tinnitus markedly decreased.

Nov. 24, 1942: Has taken 30 tablets of a popular drug containing quinine, because of dental pain. Hearing is worse but tinnitus remains much less than originally. Navatol substituted for oleum percomorphum, dicalcium phosphate powder, one level tablespoonful instead of dical D tablets. Fifteen injections of thiamin hydrochloride 16,000 units, then 15 injections of niacin mgm. 25 B_1 niacin, riboflavin tablets discontinue.

On Aug. 20, 1943, patient returned for a check-up. Thinks hearing is better than when last seen.

Whispered voice test from rear with both ears open.

	Sibilant Nos.	Nonsibilant Nos.	Sentences
7/ 3/41	0	0	0
8/20/43	5 ft.	4 ft., 3 in.	9 ft.

Masking, whispered voice.

Right 7/ 3/41	1 in.	1 in.	0
Right 8/20/43	9 ft., 4 in.	7 ft., 5 in.	3 ft.

Masking, whispered voice.

Left 7/ 3/41	3 in.	1 in.	1 in.
Left 8/20/43	5 ft., 6 in.	2 ft., 8 in.	6 in.

Treatment: Two capsules of navatol, eight tablets brewer's yeast, ryzamin B No. 2 two measures, one heaping teaspoonful of dicalcium phosphate in hot water (plus juice of one-half lemon) upon arising, one heaping teaspoonful of lactose, injections of thiamin hydrochloride.

Comment: In two years we note a marked improvement in voice perception which does not correspond with the audiometry which shows no improvement, left, and a very moderate change on the right. The improvement for speech perception which has been noted both by the patient and her husband must be ascribed to improved cerebral metabolism and not to any change in the end-organs.

Case 4: H. Mc., male, age 31. May 3, 1943.

Impaired hearing since 1929. By 1931 it had progressed markedly. No history of quinine or exposure to loud noise or otitis media. Tinnitus is constant; began in right ear, now in both. For two years has had constant pain in both ears. Basal metabolic rate, minus 13. Wassermann negative. Family History: One brother deaf. Father is deaf. A paternal aunt deaf. Mouth, fauces, oropharynx and nasopharynx negative. Nose: Deviation of septum to right. Ethmofrontal sinusitis right. Patient is underweight. Drum membranes negative except for a very slight injection. Eustachian tubes widely patent. Constant roaring tinnitus both ears. Fork Tests: C 64 heard, left; no right. Rinne negative, right and left. Weber lateralizes to right. Schwabach 18 seconds, right; 23 seconds, left.

Voice test, from rear, both ears open, whispered voice:

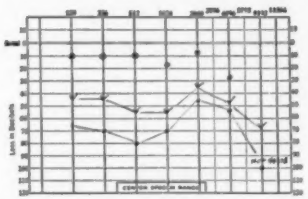
	Sibilant Nos.	Nonsibilant Nos.	Sentences
5/13/43	18 ft.	20 ft.	20 ft.
9/17/43	20 ft.	20 ft.	20 ft.

With masking, whispered voice:

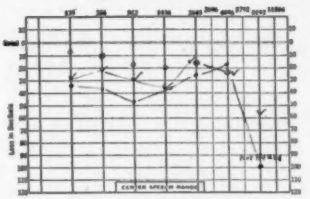
Right	5/13/43	7 ft., 4 in.	7 ft.	1 ft., 10 in.
Right	9/ 7/43	7 ft., 7 in.	7 ft., 6 in.	4 ft., 7 in.
Left	5/13/43	20 ft.	20 ft.	20 ft.
Left	9/ 7/43	20 ft.	20 ft.	20 ft.

Vestibular: No spontaneous nystagmus or deviation on pointing. Romberg and pelvic girdle reaction negative. After-turning nystagmus — to right, 21 seconds, — to left, 20 seconds.

Audiometry: Air and Bone conduction curves symmetric for both ears. Right — air conduction, dips to 80 dcb. at 512 and 8,192 is not heard. On the left, 512 dips to 46 dcb. and 8,192 is not heard. This type of curve



Case 4. H. Mc. Age 31. Right ear.
Air conduction 5/11/43 •
8/24/43 ✓
Bone conduction 5/11/43 o



Case 4. H. Mc. Age 31. Left ear.
Air conduction 5/11/43 •
8/24/43 ✓
Bone conduction 5/11/43 o

suggests not only involvement at the site of predilection but also at the round window region.

A study of a seven-day food intake by Michael Walsh disclosed the following:

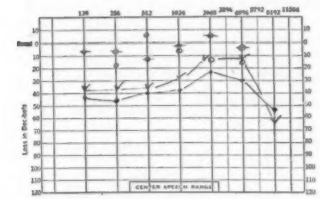
	Daily Average	Estimated Requirement	
Protein	94 grams	125 grams	25% deficient
Fat	97 grams	56 grams	73% excessive
Carbohydrate	202 grams	250 grams	20% deficient
Calories	2060	2000	3% excessive
Calcium	567 milligrams	1000 milligrams	43% deficient
Phosphorus	1160 milligrams	1500 milligrams	23% deficient
Iron	10.7 milligrams	15 milligrams	29% deficient
Iodine	44.4 micrograms	100 micrograms	56% deficient
Acid-base ratio	45.3 to 10.2	1 to 3	
Vitamin A	9970 units (I. U.)	10000 units (I. U.)	Optimum
Thiamin	586 micrograms	2475 micrograms	76% deficient
Riboflavin	1280 micrograms	2000 micrograms	36% deficient
Niacin	20 milligrams	24 milligrams	17% deficient
Vitamin C	20 milligrams	75 milligrams	73% deficient
Vitamin D	90 I. U.	800 I. U.	89% deficient

Dietary suggestions were made to correct the deficiences. Many items in the former diet the patient was asked to omit.

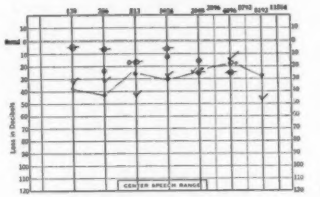
Prescribed: One heaping teaspoonful of dicalcium phosphate powder and the juice of one-half lemon in a glass of hot water upon arising. Orange or grapefruit juice before breakfast. One tablespoonful of lac-

tose (to promote absorption of calcium) used in coffee or on any food. Two navatol capsules daily. Thiamin hydrochloride, one 5 milligram tablet. Niacin, two 25 milligram tablets. Riboflavin, one 1 milligram tablet. Fifteen, twice weekly injections of thiamin hydrochloride 8000 units, insulin 5 units. Fifteen, twice weekly injections of niacin, 25 milligrams. Insulin 5 units. Five injections liver concentrate, 7½ units. On Aug. 10, 1943, the B_1, riboflavin, niacin tablets were discontinued and Galen B (rice bran concentrate) 3 teaspoonfuls daily, prescribed. Also Lugol's solution (compound solution of iodine) three drops in water at meal time. On Aug. 24, 1943, "I hear much better. Before treatment I couldn't understand my family across the room. Now I can hear fairly well across the room when anybody speaks. I had a steady earache and tenderness of ears; now have none whatever. Tinnitus is unchanged on the right. The left ear seems better. Prior to treatment I sat in the first row at lectures and heard poorly. Now on the first row I hear perfectly. Mother has remarked that I hear better."

Comment: The marked audiometric improvement (3 mos. 13 days) suggests neural change as well as improved cerebral function. Particularly interesting is the fact that 8,192 was not heard on either side on May 11, 1943, while on Aug. 24, 1943, this frequency was heard at 68 dcb. on the right and at 55 on the left. The air conduction loss was well below 50 dcb. on the right, signifying perceptive as well as conductive deafness.



Case 5. A. B. Age 42. Right ear.
Air conduction 8/25/37 ●
7/20/43 ✓
Bone conduction 8/27/37 o
7/20/43 ⊖



Case 5. A. B. Age 42. Left ear.
Air conduction 8/25/37 ■
7/20/43 ✓
Bone conduction 8/27/37 o
7/20/43 ⊖

Case 5: A. B., female, age 42 years. Aug. 24, 1937.

Twelve years ago noted bell-like tinnitus in right ear. Eight years ago hearing became impaired on the right and pulsation in right ear manifested itself. One and one-half years ago impairment of hearing in both ears was noted. Since then hearing has become progressively worse. Paracusis Willisii negative. Theater is a strain even in fifth row. Hearing in a group is very difficult. Pain in right ear occasionally. Is extremely nervous. Tremor of hands marked. No history of otitis media, exposure to noise, quinine or salicylates. B. M. R., plus 3. Mother, now 70, has grown progressively deafer since age 30 — also has tinnitus and aural pulsation. Maternal cousin deaf since age 20. Maternal uncle and aunt hard of hearing. Nose and throat negative. Drum membranes negative. Forks: Rinne negative, right and left. Weber not lateralized. Schwabach prolonged, right and left. Vestibular reactions normal.

Voice test, with masking, whispered voice:

	Sibilant Nos.	Nonsibilant Nos.
Right	4 ft.	6 in.
Left	30 ft.	4 ft.

Patient had been under the care of another otologist since Sept. 14, 1935. Numerous audiograms showed progressive deafness. Diagnosis: Otosclerosis. A dietary study was made and the various factors brought to requirement. Prescribed dicalcium phosphate, gms. 4 with vitamin D, 2500 units, vitamin B complex syrup (rice bran concentrate) 2 drachms, 10 brewers yeast tablets, lactose, one tablespoonful; haliver oil capsules, two. Later in place of rice bran concentrate were prescribed synthetic B, niacin and riboflavin tablets and intramuscular injections of thiamin hydrochloride and niacin.

May 2, 1939: No tinnitus except at short intervals in the morning.

Nov. 29, 1939: Tremor of hands has disappeared.

March 26, 1940: Has gained 10 pounds. General health much improved. Is not as nervous. Colds less frequent. Fingernails much stronger. No longer has to take laxatives. Goes many days without pulsation in ears and when present is never as loud as previously. A crackling sound in ears formerly present is now never heard. Hearing is improved. Had a tenth row seat at theater and heard well. Patient is convinced that thiamin hydrochloride is much more effective for tinnitus when injected than when taken orally. Has been injecting at home twice weekly: B_1, 16,000 units. Niacin, 25 mg. Is taking orally one teaspoonful dicalcium phosphate, one tablespoonful lactose, one navatol capsule, four brewer's yeast tablets, three teaspoonfuls Galen B (rice bran concentrate).

Voice test, Dec. 3, 1940, with masking: whispered voice:

	Sibilant Nos.	Nonsibilant Nos.	Sentences
Right	14 ft.	14 ft., 6 in.	2 ft., 4 in.
Left	40 ft.	20 ft.	4 ft., 3 in.

On Oct. 17, 1941, whispered voice, with masking:

Right	22 ft.	17 ft.	7 ft., 3 in.
Left	40 ft.	20 ft.	15 ft., 6 in.

On Sept. 30, 1942: whispered voice, with masking:

Right	Normal	Normal	8 ft., 2 in.
Left	Normal	Normal	11 ft., 10 in.

On July 20, 1943, from rear with both ears open, whispered voice:

	Normal	Normal	17 ft.

With masking, whispered voice:

Right	Normal	Normal	17 ft.
Left	Normal	Normal	14 ft., 3 in.

Intramuscular vitamin injections discontinued. Prescribed: (1) one heaping tablespoonful lactose; (2) three dical D tablets; (3) two navatol capsules; (4) three brewer's yeast tablets; (5) compound solution iodine, four drops t.i.d.; (6) three teaspoonfuls Galen B. (rice bran concentrate).

Comment: As a result of improved diet and vitamin therapy a number of interesting changes have occurred. Extreme nervousness and marked tremor of hands have disappeared. Aural pulsation and tinnitus have decreased. There has been a gain in weight, improved appetite and improved general health. Fingernails, which had always been brittle and thin, have become much stronger.

Audiometrically there has occurred a moderate improvement on the right, none on the left; while with the voice test there is shown a very marked improvement in hearing. This improvement has been commented upon frequently by all members of the family and by friends. This

improvement cannot be ascribed to any change in the end-organs but must be the result of improved cerebration.

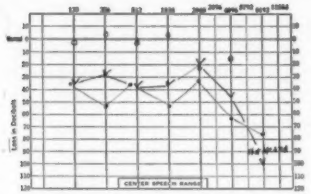
Case 6: J. V., male, age 20. Jan. 27, 1940.

Impaired hearing for three years. Paracusis Willisii positive. Wassermann negative. No history of otitis media or quinine therapy. Tinnitus, both ears. Frequent colds and sore throat. Nasal obstruction.

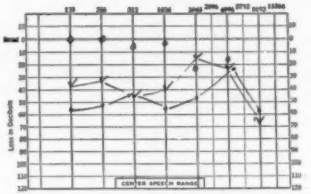
Family History: One brother is hard of hearing. Another brother, father and mother have normal hearing. Examination revealed many dental fillings, chronic tonsillitis, deviation of septum and hypertrophied posterior ends of inferior turbinates. B. M. R., minus 23. Drum Membranes: Right, pink shimmer, impaired mobility of malleus; left, retracted, impaired mobility of malleus. Eustachian tubes freely patent. Forks: C64 is not heard, Weber not lateralized, Rinne is negative on both sides. Schwabach markedly prolonged. On Aug. 3, 1940, tonsillectomy. On Dec. 19, 1940, submucous resection.

Diagnosis: Otosclerosis, mild tympanal fibrosis, bilateral.

Treatment: Diet analysis and regulation. Thyroid gr. ½. One heaping teaspoonful of dicalcium phosphate in hot water upon arising. One



Case 6. J. V. Age 20. Right ear.
Air conduction 1/29/40 •
6/ 8/42 ✓
Bone conduction 1/29/40 O



Case 6. J. V. Age 20. Left ear.
Air conduction 1/29/40 •
6/ 8/42 ✓
Bone conduction 1/29/40 O

navatol capsule. Thiamin hydrochloride, 6.66 mg. twice daily. Six brewer's yeast tablets. Viosterol, 10 drops. Two 25 mg. niacin tablets. Several series of injections of thiamine hydrochloride and insulin. Several forms of rice bran concentrate were taken at times in place of the synthetic B, and niacin tablets. Lip-reading instruction was urged but not taken. A hearing aid was finally acquired.

Voice tests: whispered voice with masking:

		Sibilant Nos.	Nonsibilant Nos.	Sentences
Right	1/27/40	1 in.	3 in.	1 in.
	11/30/40	7 ft., 3 in.	1 ft., 4 in.	1 ft., 9 in.
	9/22/41	2 ft., 3 in.	2 ft., 2 in.	2 ft., 3 in.
	6/10/42	16 ft.	13 ft., 4 in.	9 ft.
		Sibilant Nos.	Nonsibilant Nos.	Sentences
Left	1/27/40	3 ft.	0	0
	11/30/40	8 ft., 10 in.	3 ft., 4 in.	1 ft., 5 in.
	9/22/41	7 ft., 2 in.	6 ft., 9 in.	2 ft., 5 in.
	6/10/42	17 ft.	17 ft.	10 ft., 5 in.

On July 27, 1942, patient stated he rarely found his hearing aid necessary.

Comment: In this case of otosclerosis, there occurred a rather marked improvement both audiometrically and by voice test. The patient's general health has also improved.

Case 7: A. W., female, age 61. April 29, 1941.

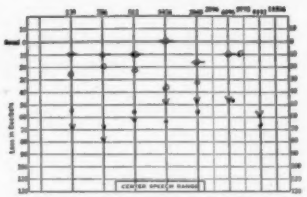
Impaired hearing since age 39. Paracusis Willisii positive. Deafness progressive. Has had prolonged treatment with inflation (elsewhere) without improvement. No history of otitis media. Received quinine frequently in childhood.

Family History: Father deaf from early life. One brother and one sister very hard of hearing. Another sister has tinnitus and moderate impairment of hearing.

Nose negative. Chronic purulent tonsillitis. Eustachian tubes normally patent. Drum membranes negative with normal mobility of malleus.

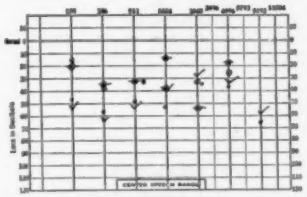
Forks: Rinne negative, right and left. Schwabach prolonged. Normal after-turning nystagmus.

Diagnosis: otosclerosis.



Case 7. A. W. Age 61. Right ear.

Air conduction	5/ 5/41	●
	3/25/42	✓
Bone conduction	5/ 5/41	○
	1/21/42	⊖



Case 7. A. W. Age 61. Left ear.

Air conduction	5/ 5/41	●
	3/25/42	✓
Bone conduction	5/ 5/41	○
	1/21/42	⊖

Treatment: Diet analysis and regulation. Orally, dicalcium phosphate powder, lactose, oleum percomorphum, synthetic thiamin hydrochloride, niacin and riboflavin alternating with rice bran concentrate. A series of thiamin hydrochloride and then liver injections.

On May 29, 1942, tonsillectomy.

Voice tests, whispered voice, with masking:

		Sibilant Nos.	Nonsibilant Nos.	Sentences
Right	5/ 5/41	2 in.	0	0
	4/ 1/42	20 ft.	18 ft.	4 ft., 2 in.
Left	5/ 5/41	18 ft.	2 ft., 4 in.	6 in.
	4/ 1/42	18 ft.	20 ft.	9 ft., 9 in.

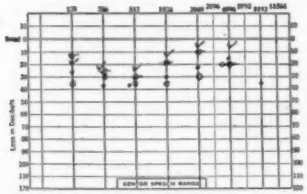
Comment: Audiometrically the right ear shows for air conduction but little change, although the 13 dcb. improvement for frequency 1,024 may have some significance. Bone conduction on the other hand has shown a marked improvement throughout the speech range. The left ear, air conduction, is essentially unchanged except for 11 dcb. improvement for 1,024 frequency. By bone conduction all frequencies are unchanged except for an improvement of 23 dcb. for 1,024 and 20 dcb. loss for 2,048. Were audiograms comparable to the hearing of speech, one would conclude that since there is a moderate improvement in the middle of the speech range on both sides in air conduction there would have occurred

a moderate improvement in the perception of voice sounds. This patient and her friends have noted a marked improvement in hearing and the voice test shows this improvement to be a fact. The improved bone conduction on the right, I believe demonstrates a certain degree of neural regeneration but we certainly cannot explain the enormous improvement in hearing by anything shown in the audiogram. This patient is a teacher of lip-reading in a nearby city. The daily trip in a bus and the work itself caused such marked fatigue that at the time treatment was begun she had decided to discontinue her work. She noted shortly after a proper diet was given and vitamin therapy begun, that her fatigue had decreased. This improvement has continued and increased until now she finds her work not only possible but is carrying on with comfort.

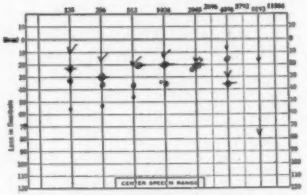
I can only conclude that along with her marked improvement in general health there has occurred a changed cerebral function which accounts for her improved hearing. It is understood, of course, that all voice tests are made without the possibility of lip-reading. The patient never faces the examiner. A paper-rub masking is used for voice tests.

Case 8: N. W., female, age 51. June 19, 1941.

For three months has noted tinnitus and impaired hearing, left ear. Pulsation in right ear. When she hums, a double tone is perceived on the left. Nose negative. Chronic tonsillitis. Drum membranes are nega-



Case 8. N. W. Age 51. Right ear.
Air conduction 6/23/41 ●
5/ 5/42 ✓
Bone conduction 6/23/41 ○
5/ 5/42 ⊖



Case 8. N. W. Age 51. Left ear.
Air conduction 6/23/41 ●
5/ 5/42 ✓
Bone conduction 6/23/41 ○
5/ 5/42 ⊖

tive with normal mobility. The left Eustachian tube is freely patent; the right very moderately obstructed. With fork, E below middle C, the Rinne is positive, right, but negative, left. C64 is heard on the right only. Weber lateralizes to the right.

Voice test from rear, both ears open:

	Sibilant Nos.	Nonsibilant Nos.	Sentences
Conversation voice	18+ ft.	20 ft.	18 ft.
Whispered voice			14 ft.
Whispered voice, with masking:			
Right	18 ft.	15 ft., 5 in.	15 ft., 9 in.
Left	15 ft.	13 ft., 4 in.	13 ft., 11 in.

Comparison of the two ears with forks:

C64 right, single tone: left, double tone, higher than right.
C128 right, single tone: left, one octave higher.
C256 right, single tone: left, single tone lower than right.
C512 right, single tone: left, double tone lower than right.
C1,024 right, single tone: left, single tone lower than right.
C2,048 right, single tone: left, single tone same as right.
C4,096 right, single tone: left, single tone same as right.

After-turning nystagmus normal. Treatment: Diet analyzed and regulated. Prescribed ryzamin B No. 2 (rice bran concentrate), oleum percomorphum (vitamins A and D), synthetic niacin and thiamin hydrochloride, potassium chloride. Later potassium iodide was given. Ryzamin B No. 2 was alternated with Galen B (rice bran concentrate) and with brewer's yeast. Several series of injections of niacin and insulin, thiamin hydrochloride and liver extract, thiamin hydrochloride and insulin, liver and insulin, were given. On Aug. 1, 1941, tonsillectomy. Tinnitus had decreased but diplacusis continued. Patient's own voice caused vibration in ears and diplacusis. On Oct. 3, 1941, hearing improved. Diplacusis had disappeared. On Dec. 12, 1941, the voice test showed normal hearing for both ears excepting sentences with whispered voice on the left, which were heard 17 ft. There was no longer any pulsation in right ear. On April 10, 1942, diplacusis still absent except on loud whistling. On May 5, 1942, very loud sounds cause a vibration in ears. No diplacusis. The roaring tinnitus has disappeared but ringing is noted. When palm is placed over left ear and quickly removed there is a metallic sound. This does not occur on the right. No pulsation in right ear. All forks heard as single tones, right and left; but all are perceived at slightly higher pitch on the left. Comment: This interesting case of diplacusis occurred in a cellist whose musical career was profoundly disrupted by the aural condition. The diplacusis disappeared two months after tonsillectomy. Whether the labyrinthine involvement resulted from toxic absorption from the tonsils or from vitamin deficiency, I do not know. Since no vertigo or nausea occurred and after-turning nystagmus was normal, one doubts that a change in intralabyrinthine pressure was a factor, although such a change in the cochlea alone is probably possible. The lateralization in the Weber test to the right is understandable but the negative Rinne, left, is not. The marked improvement by air conduction, on the right, throughout the range of frequencies and the change in bone conduction, shows that the right ear was also involved in the process. On the left, a much greater improvement occurred by air conduction for 128 to 1,024 inclusive, but for 4,096 and 8,192 there was very marked loss at the final audiometry both by air and bone conduction. Evidently this portion of the left cochlea was damaged beyond repair. The disappearance of diplacusis on the left enabled the patient to continue her musical activities despite the persistence of a slight difference in pitch, right and left. In addition to the marked improvement in hearing, the patient reports that her endurance, appetite and general feeling of well being are all enormously improved over anything she has ever experienced.

Case 9: S. C., female, age 30. Nov. 4, 1939.

Tinnitus present for two years. At onset a hearing test showed normal hearing. Gave birth to a daughter, Aug. 24, 1939. Since then, impairment of hearing has been noted. Wassermann negative. No history of otitis media, quinine, trauma or exposure to loud noise. Family history negative for deafness. Drum membranes negative, Eustachian tubes freely patent. Rinne negative, right and left. Schwabach prolonged. C64 fork not heard.

A seven-day diet was analyzed and a corrected diet list given.

Prescribed dical D, navatol, thiamin hydrochloride, niacin, brewer's yeast and lactose. Later, dicalcium phosphate powder to replace the dical D tablets. Later, ryzamin B No. 2 in place of thiamin and niacin. A series of intramuscular injections of thiamin hydrochloride, niacin, liver extract and insulin were given.

On April 7, 1942, the voice test showed a marked improvement in hearing. Audiometry remained the same.

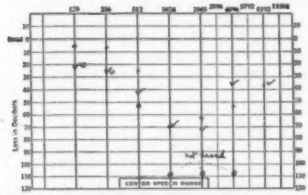
Whispered voice with masking:

		Sibilant Nos.	Nonsibilant Nos.	Sentences
Right	11/20/39	18 in.	1 in.	1 in.
	4/ 7/42	10 ft., 8 in.	13 ft., 8 in.	3 ft., 9 in.
Left	11/20/39	16 in.	6 in.	2 in.
	4/ 7/42	20 ft.	17 ft.	5 ft.

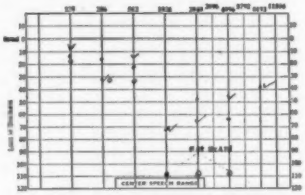
Case 10: R. B., male, age 15. Oct. 28, 1939.

Impaired hearing since age 6. Purulent otitis media, bilateral, age 5. Adenoidectomy had been performed at two. Tonsil operation at four. At 12, secondary tonsillectomy and adenoidectomy. Has had frequent colds. Constant nasal obstruction and discharge. Sneezes frequently. One attack of hives. Many foods disagree with him. Wassermann negative. Occasional tinnitus. X-ray shows antra and ethmoids hazy. Nasal smear — enormous number of eosinophiles, many in clumps. Drum membranes negative with normal mobility. Nose: Typically allergic mucosa. Septum markedly deviated. Posterior ends of inferior turbinates hypertrophied. Family History: Mother has nasal allergy and had purulent otitis media, bilateral at 12.

Audiometry showed a marked loss of high tone perception, right and left (down to 70 dcb. in middle of speech range. Bone Conduction: No perception for 1,024 to 4,096 inclusive, right and left. Diet had been very



Case 10. R. B. Age 15. Right ear.
Air conduction 10/30/39 ●
2/23/42 ✓
Bone conduction 10/30/39 O



Case 10. R. B. Age 15. Left ear.
Air conduction 10/30/39 ●
2/23/42 ✓
Bone conduction 10/30/39 O

poor. Practically no vegetables were eaten. Very temperamental about all foods. Foods eaten one day were rejected the next day. Fortunately just at the time treatment was begun the boy started a course of dietetics at school which aroused great interest. From that time, all suggestions from me were taken seriously and followed. Exclusion tests were made and many foods were found to produce attacks of allergy; particularly chocolate, cream and milk. In addition to diet regulation, the following items were prescribed: dicalcium phosphate, niacin, thiamin hydrochloride, brewer's yeast, navatol (vitamins A and D). Tincture of iodine was given for several months. Cofron (liver concentrate). Later, potassium iodide was given for several months. Intramuscular injections of thiamin hydrochloride, liver and insulin were given in several series during the period Oct. 28, 1939, to Feb. 23, 1942. In addition to a change in hearing, some very interesting psychic changes occurred. Prior to treatment R. B. was a very poor student, refused to associate with other boys and girls, was morose around his home. His weight increased during treatment from 101½ to 122¾ pounds. He became an excellent pupils and received high marks. Before treatment he was in special classes for the hard of hearing and had to sit in front. Later, he attended only regular classes and could get along in every part of the classroom. In place of avoiding other children, he became quite socially active and changed his behavior at home from moroseness to cheerful-

ness. On Feb. 14, 1941, a submucous resection and posterior end operation was performed. Audiometry remained unchanged on the left. On the right there was some loss for frequencies 128, 256 and 512 and a gain for 4,096. Despite this, the voice test and all the experiences of the patient proved a definite improvement in hearing.

Voice test: Masking, conversation voice:

		Sibilant Nos.	Nonsibilant Nos.	Sentences:
Right:	10/31/39	12 ft.	12 ft., 4 in.	4 in.
Right:	2/23/42	20 ft.	15 ft., 10 in.	10 ft., 2 in.
Left:	10/31/39	7 ft., 6 in.	12 ft.	5 ft., 6 in.
Left:	2/23/42	20 ft.	20 ft.	17 ft.

Whispered voice:

Right:	10/31/39	0	8 in.	0
Right:	2/23/42	6 ft., 4 in.	3 ft., 3 in.	1 in.
Left:	10/31/39	0	1 in.	1 in.
Left:	2/23/42	13 ft.	9 ft.	1 ft., 7 in.

Comment: The bilateral otitis media at five seems to have produced a profound neuropathy instead of the usual tympanal fibrosis. The normal drum membranes with no impairment of malleus mobility point to clear middle ears; at any rate to no marked fibrosis. The most interesting phase in this case is the improved hearing for speech with no improvement audiometrically. This boy was profoundly introverted. Silent and morose about the home, without interest in school and other children, he was withdrawing more and more from reality. His nasal allergy and obstruction and his very poor diet contributed to his lack of alertness and interest in the world outside his own brain. The relief of nasal obstruction and allergy through surgery and exclusion of offending foods, improvement in general health through vitamin therapy and dietary regulation changed the patient into an alert, social being. Along with these changes came a marked improvement in cerebral function which explains his hearing improvement. In 1943 when R. B. was examined by his draft board, where only voice tests are made, he was promptly accepted for the army! He would have been rejected had audiometry been done and voice tests not made.

Case 11: E. M., female, age 36. June 16, 1939.

Impaired hearing since 15. One month pregnant. Tinnitus developed several months ago. One son 4 years old. After the birth of this child, hearing became much worse. Received no calcium during the first pregnancy. No history of otitis media.

Drum membranes are negative. The right shows a pink shimmer. Eustachian tubes patent. Rinne negative, right and left. Schwabach prolonged. Nose and nasopharynx negative. Tonsils have been removed. After-turning nystagmus hyperactive. Pregnancy interrupted. Diet analysis was made and all deficiencies corrected. Outstanding were the deficiencies for vitamin B, and D. Injections were given twice weekly of 16,000 units of thiamin hydrochloride and five units of insulin; later, niacin 25 mgm., and five units of insulin. Orally: brewer's yeast, niacin, cevitamic acid, thiamin hydrochloride, haliver oil, dicalcium phosphate powder and lactose. Later, in place of B factors named, a rice bran concentrate was given. The series of injections were repeated several times. On April 6, 1942, the audiogram showed no improvement but the voice test showed a favorable change and the patient was conscious of hearing improvement.

Conversation voice test, with masking:

		Sibilant Nos.	Nonsibilant Nos.	Sentences
Right:	6/16/39	2 in.	4 in.	1 in.
	4/ 6/42	10 ft., 4 in.	8 ft., 5 in.	8 ft., 3 in.
Left:	6/16/39	4 in.		11 in.
	4/ 6/42	13 ft., 3 in.		10 ft., 4 in.

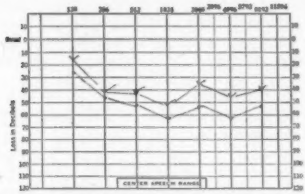
Case 12: G. E. L., male, age 45. Nov. 28, 1940.

Impaired hearing and tinnitus since exposure to gunfire on a U. S. destroyer, 1917. Years previously had O. M. P. A. complicating influenza. Father and paternal grandfather were deaf.

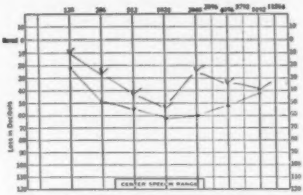
Nose and nasopharynx negative. Tonsils have been removed. Right drum membrane shows a small central scar — mobility normal. The left drum membrane negative in appearance. Malleus fixed. Rinne positive, right and left. Normal after-turning nystagmus.

Diet was regulated. Prescribed B complex concentrate and tablets of thiamin hydrochloride, niacin and riboflavin. Oleum percomorphum.

March 18, 1941: Both patient and his wife are convinced that hearing has improved. Tinnitus has disappeared completely. General health



Case 12. G. E. L. Age 45. Right ear.
Air conduction 11/28/40 ●
5/19/41 ✓



Case 12. G. E. L. Age 45. Left ear.
Air conduction 11/28/40 ●
5/19/41 ✓

improved. Patient, a physician, can now examine a chest with much greater ease. Can now use the phone, whereas formerly his wife had to speak for him.

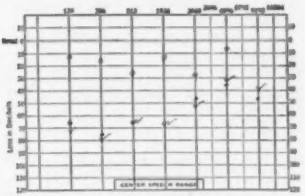
Case 13: C. C., male, age 38. Dec. 17, 1940.

Hearing impaired for six years. Roaring tinnitus, right. Many attacks of purulent otitis media, right. Frequent headaches, marked nasal obstruction. Allergy: nasal, angioneurotic edema, hives. Wassermann negative. B. M. R. was minus 17. Had taken thyroid prior to examination until B. M. R. became minus seven. Blood — hemoglobin, 70 per cent; reds, 4,200,000; W. B. C., 7,000. Mother became deaf at middle age. Drum membranes negative and with normal mobility. Chronic purulent tonsillitis. Nose: allergic mucosa, marked hypertrophy of left middle turbinate, polypi in right postethmoid. Inferior turbinates hypertrophied. X-ray — both antra, left sphenoid and anterior ethmoids cloudy. Frontal sinuses negative. Forks: C64 not heard. Weber lateralized to left. Rinne negative, right and left. Schwabach slightly prolonged. Normal after-turning nystagmus.

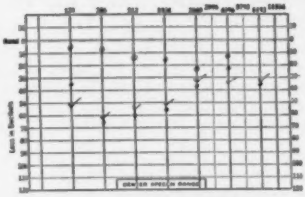
Voice test, whispered voice, masking:

		Sibilant Nos.	Nonsibilant Nos	Sentences
Right:	12/17/40	3 ft., 6 in.	8 in.	0
	11/27/41	20 ft.	14 ft., 10 in.	1 ft., 3 in.
Left:	12/17/40	8 ft., 3 in.	2 ft.	1 in.
	11/27/41	20 ft.	10 ft., 9 in.	2 ft., 2 in.

Treatment: Dietary regulation. Dicalcium phosphate powder, rice bran (B complex) concentrate, oleum percomorphum, thiamin hydrochloride tablets. Injections of thiamin hydrochloride and insulin, niacin and insulin, thiamin hydrochloride and liver were given over a long period.



Case 13. C. C. Age 38. Right ear.
Air conduction 12/20/40 ●
11/27/41 ✓
Bone conduction 12/20/40 O



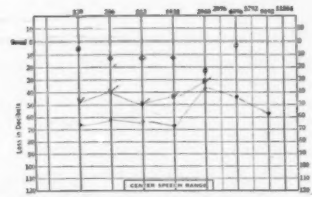
Case 13. C. C. Age 38. Left ear.
Air conduction 12/20/40 ●
11/27/41 ✓
Bone conduction 12/20/40 O

Operations: On Jan. 20, 1941, tonsillectomy was performed. On March 28, 1941, antrum window operation (right and left), anterior walls of sphenoids removed, subturbinal ethmoid exenteration, hypertrophies of inferior turbinates removed.

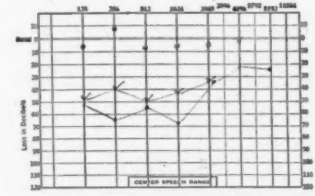
Comment: With no audiometric change from Dec. 20, 1940, to Nov. 27, 1941, there occurred a marked improvement in hearing which is proven by voice test, the patient's experience, statements of his wife and associates. There has also occurred a marked improvement in general health.

Case 14: W. S., female, age 47. Aug. 15, 1941.

Impaired hearing, 20 years. Received quinine in large amounts for typhoid at age six; also frequently for colds. No otitis media. Had glycosuria which had disappeared after B complex therapy.



Case 14. W. S. Age 47. Right ear.
Air Conduction 8/15/41 ●
4/ 4/42 ✓
Bone conduction 8/15/41 O



Case 14. W. S. Age 47. Left ear.
Air Conduction 8/15/41 ●
4/ 4/42 ✓
Bone conduction 8/15/41 O

Nose and throat negative.

Drum membrane, right, negative with normal mobility. Left, negative, malleus fixed. Normal turning reaction. Rinne negative, right and left. Schwabach prolonged. C64 not heard.

Treatment: Dietary regulation; routine dicalcium phosphate and oral vitamin therapy.

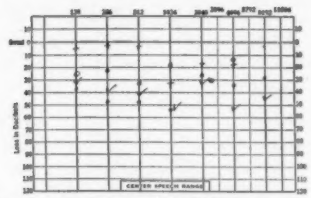
Case 15: M. B., female, age 34. Sept. 19, 1941.

At age 26, window resection for chronic sinusitis. One year later, the left ear was deaf and impairment on the right was noted. After two

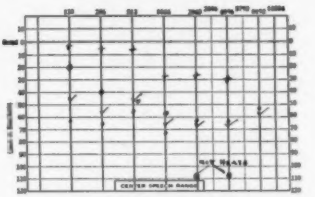
months the right ear recovered and no further change in ears was noted until age 30 — when, following pregnancy, the right ear showed impairment which has been progressive. A second pregnancy at age 33 was followed by increased progressiveness of hearing impairment. No history of otitis media. Subject to asthma and hay fever. Wassermann negative. Father has been deaf for years. Three sisters and one brother hear normally.

Mouth negative, tonsils out, lymphoid tissue present in nasopharynx. Hypertrophy of posterior ends of inferior turbinates with marked nasal obstruction. On Oct. 17, 1941, the nasal condition was corrected. Drum membranes negative with normal mobility. Eustachian tubes patent. Rinne negative, right and left. Schwabach normal. C64 not heard.

Treatment: Diet analysis and regulation. Injections of thiamin hydrochloride and insulin, niacin and insulin, liver and insulin. Orally, dicalcium phosphate, lactose, B complex concentrate from rice bran, fish liver



Case 15. M. B. Age 34. Right ear.
Air conduction 9/25/41 ●
7/30/42 ✓
Bone conduction 9/25/41 ○
7/30/42 +



Case 15. M. B. Age 34. Left ear.
Air conduction 9/25/41 ●
7/30/42 ✓
Bone conduction 9/25/41 ☾
7/30/42 +

oil, etc. Patient wears a hearing aid and is an excellent lip-reader, having studied the new methods of speech reading.

Voice test, whispered voice with masking:

		Sibilant Nos.	Nonsibilant Nos.	Sentences
Right:	9/19/41	17 ft.	13 ft., 6 in.	2 ft., 10 in.
	7/28/42	18 ft.	18 ft.	3 ft.
	3/ 4/43	20 ft.	20 ft.	6 ft., 6 in.
Left:	9/19/41	3 in.	0	0
	7/28/42	8 ft.	6 in.	0
	3/ 4/43	8 ft., 6 in.	9 in.	3 in.

Comment: The most interesting feature of this case of otosclerosis is the great improvement in bone conduction. This improvement, which enables the patient to hear much better with her hearing aid, must be looked upon as a result of neural regeneration. On March 4, 1943, audiometry showed that the bone conduction improvement had been retained.

Case 16: H. W. S., male, age 52. March 11, 1942.

In November, 1941, noted roaring in ears; more marked on the left. Accompanying the tinnitus was vertigo, nausea and vomiting. Blood pressure, usually 124/80, dropped to 90/60. The patient had been on an ulcer diet. His doctor decided his symptoms were due to vitamin deficiency and prescribed thiamin hydrochloride. Three weeks later, blood pressure was normal. Prior to the attack in November, 1941, the patient had not been conscious of any hearing impairment. No history of otitis

media, quinine or salicylate therapy. No accidents. Wassermann negative. Has been a hunter all his life. Family history entirely negative for deafness.

At the examination March 11, 1942, patient had a strep throat, which responded nicely to sulfathiazole.

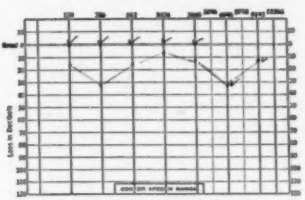
Drum membranes were negative with normal mobility. Audiometry showed moderate impairment on right, marked on left.

Vestibular tests showed impairment on the left.

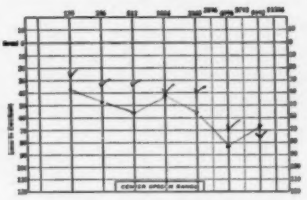
Voice test, whispered voice with masking:

	Sibilant Nos.	Nonsibilant Nos.	Sentences
Right:	20 ft. plus	20 ft. plus	20 ft., plus
Left:	9 ft., 3 in.	4 ft., 11 in.	3 in.

Treatment: Salt-free diet, ammonium chloride, potassium chloride. Fluids were limited. Steam bath twice weekly, massage three times weekly. Intramuscular injections of thiamin hydrochloride and insulin. Orally, B complex (rice bran) concentrate, fish liver oil, tablets of thiamin, niacin and riboflavin.



Case 16. H.W.S. Age 52. Right ear.
Air conduction 3/12/42 ●
6/ 9/42 ✓



Case 16. H. W. S. Age 52. Left ear.
Air conduction 3/12/42 ●
6/ 9/42 ✓

On June 9, 1942, patient reported complete freedom from vertigo and nausea except for a few minutes of vertigo on June 2 and for a short period while driving on June 6. The tinnitus had diminished markedly on the left; on the right there was none. Hearing and general health improved.

Comment: In this case of Ménière's syndrome both ears were affected, the left more. In the short period of three months the hearing on the right returned to normal except for 4,096 and 8,192, which loss may have been due to exposure to gunfire (hunting all his life). The improvement on the left was not marked but very gratifying. I was not using histamine therapy for Ménière's disease when this patient was seen.

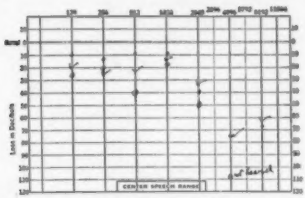
Case 17: T. V., male, age 15. Nov. 14, 1940.

Impaired hearing and tinnitus since attack of scarlet fever. No otitis media or quinine therapy. A brother has otosclerosis. Nose and throat negative. Drum membranes negative with normal mobility. Rinne positive, right and left. Weber not lateralized. Schwabach shortened, right and left. After-turning nystagmus: to right, normal; to left, 30 per cent loss.

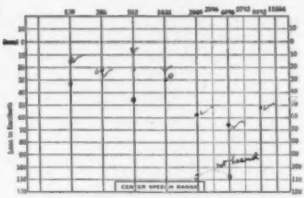
Diagnosis: Bilateral VIIIth nerve neuropathy complicating scarlet fever.

Treatment: Diet regulation, routine oral vitamin therapy. Intramuscular injections of thiamin hydrochloride and insulin, thiamin hydrochloride and liver extract, niacin, were given.

There was no improvement audiometrically but with the voice test there was an appreciable change. On May 6, 1941, patient reported tinnitus had entirely disappeared.



Case 17. T. V. Age 15. Right ear.
Air conduction 11/15/40 ●
1/ 2/42 ✓
Bone conduction 11/15/40 O



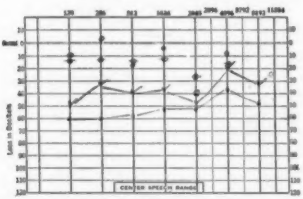
Case 17. T. V. Age 15. Left ear.
Air conduction 11/15/40 ●
1/ 2/42 ✓
Bone conduction 11/15/40 O

Voice test, whispered voice with masking:

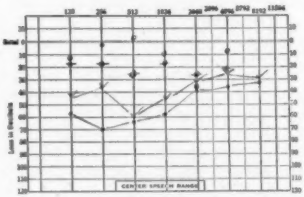
		Sibilant Nos.	Nonsibilant Nos.	Sentences
Right:	11/15/40	1 ft., 10 in.	1 ft., 3 in.	1 ft.
	7/21/41	5 ft., 7 in.	9 ft., 6 in.	3 ft., 6 in.
	10/ 4/41	9 ft., 7 in.	14 ft.	3 ft.
Left:	11/15/40	8 in.	11 in.	7 in.
	7/21/41	7 ft., 9 in.	13 ft., 5 in.	2 ft., 3 in.
	10/ 4/41	3 ft., 5 in.	3 ft., 7 in.	3 ft., 7 in.

Case 18: H. R., female, age 27. Jan. 24, 1939.

Impaired hearing, left, four years; right, one year. Tinnitus for three years, now more marked on right. At 15 had otitis media with spontaneous rupture. Doesn't remember which ear was affected. "Rheumatism" at age five. No quinine therapy. Paracusis Willisii negative. No



Case 18. H. R. Age 27. Right ear.
Air conduction 1/24/39 ●
7/15/43 ✓
Bone conduction 1/24/39 O
8/ 3/43 ⊖



Case 18. H. R. Age 27. Left ear.
Air conduction 1/24/39 ●
7/15/43 ✓
Bone conduction 1/24/39 O
8/ 3/43 ⊖

history of trauma. September, 1938, miscarriage. Wassermann negative. Family history negative for deafness. Nose and throat negative. Drum membranes negative with normal mobility. Forks: Rinne negative, right and left. Weber lateralizes to left. Schwabach prolonged on both sides. C64 is not heard. After-turning nystagmus normal.

Voice test, whispered voice with masking:

		Sibilant Nos.	Nonsibilant Nos.	Sentences
Right:	1/24/39	20 in.	1 in.	1 in.
	8/ 3/43	16 ft., 4 in.	15 ft., 9 in.	4 ft.
Left:	1/24/39	3 ft., 7 in.	13 in.	2 in.
	8/ 3/43	20 ft.	16 ft., 3 in.	4 ft., 8 in.

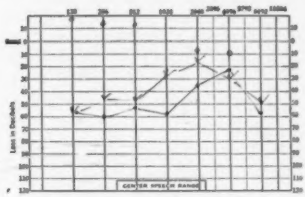
Became pregnant in July, 1939.

Treatment: Patient was advised to study lip-reading but did not do so. The possible effect of pregnancy upon her hearing was discussed, but she and her husband decided to have a child regardless of results.

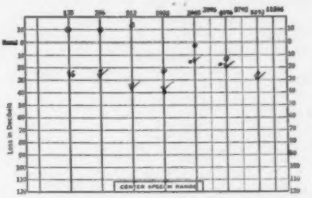
In addition to dietary regulation, the usual calcium and vitamin therapy was prescribed. Many separate series of injections of thiamin and insulin, niacin and insulin and liver were administered. Calcium and vitaman D were greatly increased during the pregnancy. The little daughter, to date, has perfect hearing. At present with four feet of whispered voice for sentences, the patient has difficulty in hearing under very few conditions and will not wear a hearing aid. Her general health is vastly improved. An interesting change is in her fingernails, which are worn quite long. Prior to treatment, one of her great problems was the frequent cracking and breaking of her nails. This rarely occurs now.

Case 19: H. G., female, age 35. April 14, 1943.

Progressive deafness for eight years. Impairment was first noted following appendectomy. Has had much inflation without improvement. Recently developed a pounding sensation in ears; "rushing" sound when



Case 19. H. G. Age 35. Right ear.
Air conduction 4/15/43 •
7/ 6/43 ⌄
Bone conduction 4/16/43 O



Case 19. H. G. Age 35. Left ear.
Air conduction 4/15/43 •
7/ 6/43 ⌄
Bone conduction 4/16/43 O

nervous or fatigued. One week prior to examination developed a flute tone in right ear. This is heard as a definite frequency first, then follows a quiver, then one tone higher is sensed. Complete neurological examination was negative. Has never been pregnant. No history of otitis media, quinine therapy or trauma. Paracusis Willisii negative. Wassermann negative. Except for nervousness, general health is good. Family history negative for deafness. Nose and throat negative. External auditory canals show no cerumen. Drum membranes negative with normal mobility. Eustachian tubes patent.

Treatment: When first seen, phenobarbital was prescribed for extreme nervousness. Diet analysis and regulation. One heaping teaspoonful of dicalcium phosphate powder in hot water upon awakening. Fish liver oil capsules, lactose, B complex concentrate from rice bran. Injections of thiamin hydrochloride and insulin, niacin and insulin. After a short time the B_1 injections caused hives and were discontinued. Insulin produced a nervous reaction which could not be prevented with sweets. It also had to be discontinued. After three months the right ear showed

improvement both by audiometry and voice. The left ear remained the same audiometrically while with voice test it showed some loss.

Voice test, whispered voice with masking:

		Sibilant Nos.	Nonsibilant Nos.	Sentences
Right:	4/15/43	7 ft., 11 in.	2 ft., 5 in.	1 ft., 9 in.
	7/27/43	7 ft., 6 in.	7 ft.	3 ft., 5 in.
Left:	4/15/43	20 ft.	20 ft.	15 ft., 6 in.
	7/27/43	20 ft.	19 ft.	9 ft., 7 in.

On July 2, 1943, a streak of gray hair had changed to normal color.

On July 27, 1943, patient stated the flute-like tone had disappeared except when she felt nervous and even then it no longer consisted of two tones.

Grateful acknowledgment is made to Eleanor A. Steins for the preparation of manuscript and for having made many of the audiometric tests.

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A REVIEW OF THE AVAILABLE LITERATURE ON THE PHARYNX AND PHARYNGEAL SURGERY FOR 1942.*

DR. FRANCIS E. LEJEUNE, New Orleans.

THE NASOPHARYNX.

Ridges[1] in a general discussion of the nasopharynx has expressed the belief that the control of lymphoid tissue in the pharynx offers the best means of ameliorating widespread chronic progressive deafness. He describes his technique of adenoidectomy, emphasizing the necessity of controlling bleeding, and discusses the treatment of the common cold and chronic postnasal irritation.

THE PHARYNX.

Ruskin[2] calls attention to the importance of differentiating between primary atrophic rhinitis (ozena) and secondary atrophic rhinitis in the proper use of estrogenic therapy. Symptoms may be relieved by means of nasal and parenteral estrogen therapy. This medication may be administered in three ways: *1.* a nasal spray of estrogen in oil alone; *2.* a nasal spray of estrogen in oil combined with parenteral injections; and *3.* estrogen tablets by mouth. Ruskin prefers the combined nasal spray and parenteral injection of estrogen in oil. In secondary atrophic rhinitis specific therapy should be administered against the infecting organism. In some cases the sulfonamides are indicated.

Recognizing the intimate relation of the vascular supply of the nasal and nasopharyngeal mucosa, Ruskin studied the physiologic properties of the pharyngeal pituitary. This relationship suggested a direct hormonal action of the pharyngeal pituitary of the nasal mucosa. From his experiments the author concluded that a hormonal mechanism related to the pituitary gland and possessing estrogenic properties is a normal constituent of the nasal mucosa; he also believes that the

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pronounced thickening of the blood vessel walls shown in the pathologic picture of primary atrophic rhinitis is the end-result of tonic overaction of the vasoconstrictor fibres, probably caused by a deficiency of the pharyngeal pituitary. An extensive bibliography on the pharyngeal pituitary is appended.

ABNORMALITIES.

Kingsbury[3] made a cytologic study of the hypophysial complex to supplement an earlier investigation on its morphogenesis. In these earlier experiments a pharyngeal hypophysis was found in each canine fetus, and it was noted that there was continuity of the pharyngeal hypophysis with the pharyngeal epithelium. A portion of the epithelium of Rathke's pouch existed superficially as stratified squamous epithelium. The pharyngeal hypophysis is relatively constant and after birth it is characteristically cystic. Its epithelial lining varies from ciliated columnar to simple cuboidal or squamous, stratified squamous. The cyst may contain mucus, desquamated epithelial cells or debris. Examination of a small number of adult dogs suggested that a fibrotic reaction by connective tissue may be a factor in the suspected regression and occasional ultimate disappearance of the pharyngeal hypophysis of the dog. Kingsbury did not find the cellular differentiation of the pars glandularis in the pharyngeal hypophysis of the dog. A comparison of the pharyngeal hypophysis in man and dog is made. The significance of the pharyngeal hypophysis and the cellular differentiation within the definite hypophysis are discussed.

ANATOMY AND HISTOLOGY.

Oldfield[4] presents a complete discussion on cleft palate, including a detailed description of the anatomy of the palate and nasopharynx. Improper nutrition, heredity and mental deficiency have been considered as etiologic factors in the development of cleft palate. He regards the ideal age for operation between one and two years. The only contraindications in his series of 120 cases were mental deficiency and uncompensated congenital heart disease. Careful preoperative preparation is of utmost importance. The type of operation depends upon the type of cleft palate. Oldfield thus summarizes the types of treatment:

A. Primary Cases:

Group I: Complete cleft of hard and soft palate, in which there is little or no deficiency of the lateral elements (many cases of Veau Types III and IV) — a modification of Axhausen's operation.

Group II: Wide clefts of the palate in which there is also deficiency of the lateral elements (many cases of Veau Types I and II, and a few cases of Types III and IV) — Wardell's operation (V-Y elongation of the palate) with or without pharyngoplasty (depending upon the development of Passavant's cushion.

B. Secondary Cases — Defects in the Palate Following Previous Unsuccessful Operations:

Group III: Complete residual cleft of hard and soft palate with moderate scarring — Wardell's operation and pharyngoplasty; severe scarring — Gillies-Fry operation to repair soft palate.

Group IV: Complete closure of cleft with gross shortening (push-back operation) (Moorhead or Dorrance) with pharyngoplasty.

Group V: Residual cleft of soft palate and posterior third of hard palate (or soft palate only) — Wardell's operation with pharyngoplasty.

Group VI: Residual gaps in the palate — treatment depends upon the size and position of the defect.

These techniques are described and illustrated.

Meticulous postoperative care including infusions and transfusions is essential to success. The author advocates the immediate institution of speech training supervised by the surgeon as soon as the palate has healed. In 116 cases there were three deaths (2.6 per cent) and favorable speech results were obtained in 86.3 per cent of cases.

BACTERIOLOGY.

Comparative studies conducted by Brooks and his associates[5] on the efficacy of the nasopharyngeal culture and the cough plate culture definitely demonstrated that the former

is the superior method. Of 438 nasopharyngeal cultures taken from 248 cases of pertussis and 198 cough plate cultures taken from 157 cases, 52 per cent of the nasopharyngeal cultures and 37 per cent of the cough plate cultures were positive. These authors cite similar statistics in other series of cases tested. They noted that the nasopharyngeal culture was more reliable than the cough plate method, particularly in diagnosing whooping cough in infants.

A comparison of results obtained by the nasopharyngeal swab with that of the cough plate in the diagnosis of pertussis was made by Saito and his co-workers.[6] In 210 duplicate tests the hemophilus pertussis was isolated more frequently by swab than by plate. They list the following advantages of the nasopharyngeal swab technique over the cough plate: higher percentage of positive cultures, ease of transportation and speed in obtaining the inoculum; however, it has the disadvantage of causing discomfort. The authors believe that the use of both procedures is superior to the swab method alone.

Williams and Atwood[7] advocate the use of the "blow plate" in obtaining material from the nasopharynx because it is easy on the patient and can be obtained by the public health nurse or even the parent, and is representative of the flora of an area which is frequently one of the "sewers and foci of infection of the body." The blow provides a more varied flora than does simple breathing. The method of obtaining a blow plate is described and an illustration of a blow taken by the Jennison technique, using Edgerton high speed photography, is included to show how adequate a spray can be obtained by the blow. It was found that in adults the cough plate usually yielded as many colonies as blow plates, whereas in children three to four times as many organisms often were recovered on the blow plate.

BLOOD SUPPLY.

Batson[8] has observed that little information regarding the veins of the pharynx has been given in textbooks. Reviewing the literature, he found that by 1912 all that was known about the veins of the pharynx was "that a compact submucous plexus was to be found on the anterior and the posterior walls of the pharynx toward the midline, just above the entrance

of the pharynx into the esophagus." Elze and Beck, in 1918, gave the most complete description of this region. Batson's study of the veins of the pharynx following injection of the deep dorsal vein of the penis with a latex emulsion showed an extensive submucous venous plexus in the posterior part of the mouth and in the pharynx. These vessels drain the tissues of this region. He continues, "There is a ring-like plexus around the entrance to the larynx, which is continuous with the vessels of the dorsum of the tongue in front and with the heavier midline anterior laryngeal plexus below. These vessels establish drainage connections with the superior laryngeal vein and continue into the esophageal veins. On the posterior wall the plexus has a well marked superior border but continues below with the veins of the esophagus. Other connections are with the plexus on the outside of the constrictor muscles." In general, Elze's observations were confirmed by this study. Batson believes with von Lushka that these veins are concerned with the pressure adjustments accompanying swallowing.

CARCINOMAS.

Cutler[9] studied about 850 cases of cancer of the mouth, pharynx and larynx treated in the Chicago Tumor Institute and the Hines Veterans' Hospital in an effort to influence the more radioresistant forms of cancer of the mouth, pharynx and larynx by means of new methods of Roentgen ray and radium treatment. He presents a new technique of external radiation (called "method of concentration") which appears to be more effective in the radioresistant forms of cancer of the mouth, pharynx and larynx than the methods of external irradiation now being used. Radiation consists of telecurietherapy (10 gm. radium bomb) and Roentgen rays (200 and 400 kilovolts). He states the underlying basis of this method:

"*1.* The conception that the more radioresistant forms of cancer require a higher daily dose and a shorter total treatment period (12 days or less).

"*2.* The administration, in selected cases, of an increasing daily dose through a diminishing port in order that the central, more radioresistant portion of the lesion may receive a

much larger dose than is possible when the size of the port remains constant.

"*3*. The administration of an adequate dose sufficient to produce the classic epidermite and epithelite, such dose representing the maximum treatment that can be tolerated by the normal tissues of the tumor bed."

Because the method has been in use only three and a half years, the permanence of results is not yet known; however, Cutler does state that certain carcinomas of the mouth, pharynx and larynx have shown definite regression and in many cases have completely disappeared following the concentration method of treatment.

Figi[10] reports the case of an 11-year-old boy admitted to the Mayo Clinic because of earache and a lump in either side of the neck of six months' duration. Examination revealed a hard, irregular, fixed mass about 4 cm. in diameter in either upper cervical region just below the auricle. Numerous smaller nodules extended to the base of the neck and into the supraclavicular region on both sides. A vascular, ulcerated mass filled the upper part of the nasopharynx and obstructed both choanae. Clinically, it appeared to be a highly malignant neoplasm despite the absence of deep-seated boring pain; biopsy revealed it to be a squamous-cell epithelioma, Grade IV. Surface packs of radium were applied over both sides of the face and neck; a total of 15,022 mg. hours of irradiation was administered. Ten years following treatment the patient was in excellent general health; examination of the nasopharynx was negative except for scarring, actinodermatitis on the neck and pronounced thickening. There was no evidence of malignant change.

Graham[11] presents an analysis of 30 cases of carcinoma of the hypopharynx or postcricoid area. In his cases he noted that the condition occurred in women at a relatively early age — more than half of the 28 women in his series were less than 50 years of age when the disease appeared. In the early stages the patients complained of slight difficulty in swallowing and some discomfort on deglutition. Later, there was pronounced dysphagia, an accumulation of mucus in the throat, coughing or hoarseness, and in some an enlarged gland in the neck. The average duration of symptoms in the author's

series was four and one-half months. Direct examination is necessary to make an early diagnosis. Differential diagnosis may be made by Roentgenography. The author states that irradiation has largely replaced radical operation in recent years; however, in his series disappointing results were obtained in six patients treated by irradiation. Twelve patients had radical excision of the postcricoid area and in three other cases a laryngectomy was also done. He reports in detail the cases of two patients treated surgically who survived 15 and 25 years, respectively.

Orton[12] feels that it is unfortunate that lateral transthyroid pharyngotomy is not more frequently used, because he considers it the most beneficial method of treating pharyngeal malignancies. He cites the case of a 71-year-old female on whom this operation was done for a carcinoma on the left lateral wall of the pharynx and who has remained well for seven years and another case of a 55-year-old male who lived five years following the operation. Lateral transthyroid pharyngotomy can be performed for conditions other than malignancies; Orton removed a neurofibroma of the pharynx by this method. He describes the technique.

In cancer of the oral pharynx, if the larynx is invaded, it is necessary to remove both the larynx and the pharynx *en bloc*, according to Wookey.[13] He describes the technique of this operation. Despite the fact that it is a mutilating procedure, he feels that it is justifiable for the saving of life, since the pharynx can be reconstructed to permit normal ingestion. There are some cases in which the larynx can be preserved. The technique of removing an early hypopharyngeal carcinoma with preservation of the larynx is described. The technique for removal of tumors at the upper end of the esophagus is also given. The author advocates the performance of a tracheotomy in all of these cases. Four cases in which such operations were performed are reported.

Whiteleather[14] describes a common specific malignancy of the nasopharynx which is characterized by a long history of symptoms before being accurately diagnosed, obscure location, early metastasis to the cervical glands and invasion of the pterygoid fossa and skull, great variability of symptoms radiosensitivity and ultimate high mortality. In the literature, the condition has been designated as basilioma, transi-

tional cell carcinoma, anepidermoid carcinoma, carcinoma simplex and lymphoepithelioma. It has been classified histologically into two types. Whiteleather analyzes 15 cases. Of these, five died, eight were still living but showed evidence of active disease or distant metastases, and two showed no evidence of disease two years following treatment. The author stated that following irradiation, the patient's general condition greatly improved, nasopharyngeal obstruction was usually relieved, cranial nerve involvement was alleviated, pain decreased, exophthalmos diminished and diplopia improved. He reports two cases.

DISEASES.

Coburn and Moore[15] made a two-year study of the application of salicylate prophylaxis in 186 rheumatic children who were observed before and following hemolytic streptococcal pharyngitis. Of these, 47 received prophylactic doses of sodium salicylate, 46 of whom did not contract rheumatic fever. The remainder (139) received no treatment; in 57 of these rheumatic fever developed. The authors believe that these results suggest that rheumatic fever can be prevented by the administration of salicylates during the respiratory infection and silent phase.

Emerson[16] reviewed 77 cases of acute pharyngitis and tonsillitis admitted to sick bay of a battleship during a four-month period. The patients were treated in the standard manner, but one group was treated with a merthiolate swab, topically applied twice a day, whereas the other received either sulfanilamide (14 gr. q. i. d.) or sulfathiazole in similar dosage; sodium bicarbonate (10 gr.) was given with each dose of sulfanilamide. Emerson concluded from his study that the average case of acute pharyngitis and tonsillitis is not affected by the sulfa drugs; therefore, these drugs should be used only as an adjunct to surgery in severe cases and only with specific indications such as otitis media, acute sinusitis and pharyngeal or peritonsillar abscess.

Jarvis[17] conducted a clinical study of the behavior of lymphoid tissue in the upper respiratory tract. He concluded from clinical observation: that iodine taken into the body reduced the size of lymphoid tissue in the upper respiratory

tract; that an excess of calcium opposes hypertrophy of lymphoid tissue and can be removed by raising the blood phosphorus and lowering the blood calcium by means of diet and medication; and that excess phosphorus is stored in lymphoid tissue, and as need for such storage increases lymphoid tissue increases in size.

Marcotte[18] discusses the pathology, etiology, symptomatology, diagnosis and treatment of chronic granular pharyngitis. He analyzed 29 cases of granular pharyngitis seen during the past two years. These patients received an aqueous solution of iodine internally and either cauterization with 50 per cent solution of silver nitrate or destruction by means of electrocoagulation. From a study of the basal metabolic rate in these patients Marcotte could find no evidence that iodine metabolism played any part in the production of granular pharyngitis.

DIVERTICULA.

In a lengthy article on the pharyngeal pouch, Graham[19] discusses the types, etiology, clinical features and symptoms, diagnosis, surgical treatment and results. Of the two types, the congenital and acquired, the author states that the acquired is the more common. The diverticulum is due to stretching and yielding of the muscular wall at a potentially weak area. The condition occurs about four times as often in males as in females. The patient may complain of dysphagia, regurgitation, and coughing and choking attacks; there may be an obvious swelling in the neck which can be reduced in size by pressure. The diagnosis can usually be made from the history and symptoms and confirmed by Roentgenography after an opaque meal. If the pouch is small, dilatation may give relief, but the author warns that this is rarely easy and often dangerous. The mortality rate following surgical treatment has been reduced to a minimum. One-stage resection is advocated in the case of small pouches, but the two-stage operation should be done in the majority of cases. Diverticulopexy is indicated only in frail and elderly patients. The author describes the technique of each of these operations. He has performed the two-stage resection on four patients followed by no recurrence of symptoms for a period ranging from a few months to eight years; complete relief of symptoms was obtained in two cases and improvement in one case

in which diverticulopexy was performed. In one case an inoperable epithelioma developed in the neck six years after diverticulopexy.

FOREIGN BODY.

Davis[20] reports the case of a 52-year-old man who complained of pain in the left side of his throat and difficulty in swallowing. About a year and a half before, when the patient was having the left lower molar tooth extracted the upper half of the tooth disappeared. Roentgenograms showed a foreign body deep in the pharynx. A tonsillectomy was performed and the tooth was removed from the tonsillar bed.

Morlock and Edelston[21] call attention to foreign bodies in the air passages because they feel that English physicians are far less "foreign-body minded" than their American colleagues. They report four cases, two of bones and two of nuts in the bronchus, which were successfully removed.

PAIN.

Williams and Elkins[22] describe a syndrome (myalgia of the pharynx) which they state has not been described in the literature before. The condition is characterized by acute sore throats, severe pain on swallowing and occasional attacks of hoarseness of from several months' to several years' duration. None of the usual signs of inflammation of the upper part of the respiratory tract can be found on examination; there is no evidence of change in the nasopharynx; the laryngeal mucosa is of normal color and the vocal cords move normally. To avoid overlooking the diagnosis the pharyngeal and laryngeal structures should be palpated. These patients also present a picture of sympathetic imbalance. They list seven points of identical tenderness which are found in these cases. In 1941 they saw 18 patients with this condition. Treatment consisted of a mild form of heat applied by means of a luminous infrared ray and occasionally short wave diathermy was used for about 30 days followed by massage. The authors state that this type of treatment effected relief or complete remission of the condition.

PATHOLOGY.

Crowe and his associates[23] report the results of treating a group of 209 children by irradiation of the nasopharynx

(method of Burnam). This treatment was based on the reasoning that restoration of normal ventilation of the middle ear at an early stage will prevent growth of lesions severe enough to interfere with the transmission of conversational tones. Three hundred fifty-seven untreated children were used as controls. Of those treated with radon, the tubal orifices were normal and the adenoids small or absent; whereas in the control group 31 per cent showed spontaneous regression of lymphoid tissue to such an extent that both tubal orifices were normal, and in about 15 per cent there was some regression.

The authors suggest the following practical consideration for preventing deafness in children: fight acute otitis media; radon will reduce the size of hyperplastic lymphoid masses in the nasopharynx; and suitable hearing aids should be provided for those children who do not improve with treatment.

Emerson, et al.,[24] describe an applicator which they have designed for use in irradiating the lymphoid tissue in the region of the orifice of the Eustachian tube. Because the technique of Crowe and Baylor (who first suggested the treatment of deafness with radon) is not easily available to many otologists, the authors established a simple effective method of application of as little as 25 mg. of radium with their simple applicator. This method is within the reach of most clinics. They describe their technique and present six cases illustrating the average variations encountered, which were treated by their technique. They emphasize the importance of careful selection of cases based on data obtained from the history, audiogram and nasopharyngoscopic examination. Any pre-existing infection of the upper respiratory tract should be eliminated before treatment is instituted.

Farrior and Richardson[25] describe a nasopharyngeal radium applicator which has been used since 1929 at the University Hospital in Michigan for treating conduction deafness resulting from overgrowth of lymphoid tissue around the pharyngeal orifices of the Eustachian tube. It consists of a standard 50 mg. radium capsule attached to a pliable copper wire. It is inserted through the middle meatus or along the floor of the nose. One application is placed in each side of the nasopharynx for one hour (50 mg. hours). They have had no undesirable effects. Although it is more bulky and requires a

longer period of application than the radon applicator, the nasopharyngeal radium applicator has the great advantage of requiring a much less expensive therapeutic dose.

Peele and his co-workers[26] report the case of a 32-year-old white man who had a large nasopharyngeal tumor which was removed and the area irradiated postoperatively, followed by an uneventful convalescence. Reviewing the literature, they noted that the condition was first described in 1901 by Becker. Reference to the condition in the literature may be found under such various terminology as splenomeglia lymphatica hyperplastica, malignant lymph follicle hyperplasia, follicular lymphoblastoma and giant follicular lymph follicle hyperplasia. The syndrome usually begins with gradual enlargement of the lymph nodes throughout the body involving the superficial or deep groups or both. A sensation of compression may be felt in the esophagus, tracheobronchial tree, thorax, neck or abdomen. The lymph nodes are usually discrete, movable, firm, painless and not tender, varying in size from 1 to 5 cm. or more. The pathologic picture is one of a numerical and dimensional hyperplasia of the follicles of the lymph nodes and malpighian bodies of the spleen. The germinal centers are composed of large, clear endothelioid-type cells resembling lymphoblasts, with a dense collection of mature lymphocytes about the periphery of the follicle. Spontaneous disappearance of the nodes and recurrence have been observed. In the early stage, irradiation is beneficial. Recurrences also yield to Roentgen therapy.

TUBERCULOSIS.

Spencer[27] reports several cases of pharyngeal tuberculosis occurring in patients who had eaten the flesh of animals which had died of tuberculosis. He also cites several cases of anthrax in natives, produced by handling and eating the flesh of animals dying of the disease. The patients with anthrax were successfully treated with intravenous or intramuscular injections of arsenicals.

TUMORS.

Allison[28] reports the case of a 4-year-old girl who had a malignant myoblastoma of the pharyngoesophageal junction. He was able to find only two cases in the literature. The child

complained of difficulty in breathing and swallowing and choking fits. A fairly uniform broadening of the superior mediastinum with considerable displacement of the trachea to the right was seen in the Roentgenogram. Barium showed that this broadening was due to a great dilatation of the esophagus. Esophagoscopy showed a large polypoid mass which seemed to come forward from the posterior wall of the esophagus and which proved on biopsy to be a sarcoma, probably a rhabdomyosarcoma. The tumor was never removed because the patient died after the first stage of the operation of a severe bronchial infection.

Brunner[29] reports four cases of nasopharyngeal fibroma in three of which the growth was surgically removed and exhaustive microscopic study made of the extirpated tumors. In the other case the growth was destroyed by electrocoagulation. These cases presented three findings indicative of a spontaneous involution of the tumor: *1.* hyalin degeneration; *2.* simple necrosis; and *3.* formation of cysts. Brunner considers nasopharyngeal fibromas as immature fibromas with an individual variability of their structure. They are found in young boys between the eighth and tenth years. After a few years they mature, undergo senescence and finally are resorbed or expelled. Brunner believes that because these fibromas have a life cycle similar to the nasopharyngeal tonsils, they resemble organs rather than neoplasms. In addition to connective tissue, these growths contain numerous blood vessels. They occupy an intermediary position between malignant and benign lesions. Although most investigators consider these tumors of periosteal origin, Brunner does not believe that they should be called simple periosteal fibromas because their structure is different from that of a periosteal fibroma. He expresses the opinion that they originate in all areas where the fascia basalis can be found. He is unable to explain the more prevalent occurrence in men and their usual unilateral development. Suitable methods of treating nasopharyngeal fibromas include radium application, surgical diathermy and surgical removal. The latter method, according to the author, is indicated: *1.* in older persons, and *2.* in cases of large tumors. He prefers more conservative treatment in *1.* patients who experience severe hemorrhage during biopsy; *2.* cases in which biopsy suggests sarcomatous degeneration

of the tumor; *3.* patients whose general condition is poor; *4.* cases of recurrent tumors of not too great size; and *5.* the presence of signs of intracranial involvement.

The case of a 70-year-old man with a mass of tissue successfully removed from the left lateral wall of the hypopharynx behind the larynx is reported by Davidson[30]. The microscopic report was that of tissue externally covered with a layer of well differentiated striated squamous epithelial cells.

Foster[31] presents the case of a 22-year-old white girl with a ganglion cell neuroma occupying the whole left side of the posterior wall of the pharynx, which was removed under general anesthesia. Convalescence was uneventful except for a swelling on the left side of the throat and neck, and Horner's syndrome, both of which cleared up within a few days. Foster was unable to find a similar case in the literature.

Hill[32] emphasizes the importance of careful diagnostic studies in any case of nasal obstruction in order to differentiate nasopharyngeal tumors from polypoid formations. He reports the case of a boy, aged 13, with a nasopharyngeal fibroma which had been previously mistakenly diagnosed as a polypoid sinusitis. On examination, intranasal extension with involvement of the ethmoids, orbit and sphenoid was found. A tumor in the nasopharynx was seen in the Roentgenograms. Radon implants greatly reduced the size of the mass. Erosion through the ethmoid permitted the sudden development of a pneumatocele, which disappeared within nine days under bed rest. Hill believes that this complication has never previously been reported in the literature.

In a general article on postnasal fibroma, Schuster[33] discusses the types, etiology, symptoms, diagnosis and treatment. Of rare occurrence and unknown etiology, the tumor, pathologically, lies between a true malignancy and a benign growth. Symptoms of nasal obstruction appear early with enlargement of the growth. Pressure, erosion and secondary infection develop. The diagnosis is based on the history of postnasal obstruction and severe hemorrhages in an adolescent youth and on rhinoscopic findings of a firm, smooth mass arising from the pharyngeal vault. Methods of treatment

include surgical removal, injections of various chemicals, electrolysis, galvanocautery, electrocoagulation and radiation. The author reports two cases successfully treated by surgical removal and radiation.

Quevedo[34] reports the case of a nasopharyngeal growth which he believes was a true cavernous hemangioma. The patient was a 22-year-old woman who had had headaches for a period of two years, slight difficulty in breathing through the right nostril 18 months before, with complete blockage one year before, hemorrhages, loss of weight and slight impairment of hearing. Examination upon admission to the hospital showed the patient to have chronic malaria, secondary anemia and a smooth, moderately lobulated reddish mass filling the nasopharyngeal space, which could be seen on posterior rhinoscopy. Roentgenograms revealed a mass in the nasopharynx. A benign tumor which had all "the features of a cavernous hemangioma" was removed under general ether anesthesia and the patient made an uneventful recovery.

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BOOK REVIEWS.

The Inner Ear, including Otoneurology, Otosurgery and Problems in Modern Warfare. By Joseph Fischer, M.D., Staff Member Beth Israel Hospital, Boston; formerly Associate of Adam Politzer and Senior Otolaryngologist with Gustav Alexander, Policlinic of Vienna, and Louis E. Wolfson, M.D., Instructor in Ear, Nose and Throat, Tufts Medical School; Senior Surgeon in Ear, Nose and Throat, Boston Dispensary. Four hundred twenty-one pages and index, 77 illustrations and seven tables. New York: Grune and Stratton, 443 Fourth Avenue.

This book is a concise and complete account of the anatomy, physiology and pathology of the labyrinth. It is clearly written and profusely and well illustrated.

The authors give the reader the benefit of their own considered opinions and experiences and yet have a complete bibliography.

This book deserves a place in any course for postgraduate students in otolaryngology and would prove a real help as a reference book for practicing otologists. T. E. W.

Acute Infections of the Mediastinum. By Harold Neuhof, M.D., D.S., F.A.C.S., Clinical Professor of Surgery, Columbia University College of Physicians and Surgeons, Surgeon to Mt. Sinai Hospital, and Edward J. Jemerin, M.D., F.A.C.S., Associate Attending Surgeon, Sydenham Hospital, Adjunct Surgeon, Beth David Hospital, Senior Clinical Assistant in Surgery and Research Assistant, Mt. Sinai Hospital. Four hundred and seven pages with index and 157 illustrations. Baltimore: William and Wilkins Co., 1943. Price $6.00.

The authors have treated the subject of mediastinal infections in a novel manner. They not only discuss acute infections of the mediastinum and review the literature but also illustrate the points of their discussions with 100 carefully analyzed cases.

The book is well illustrated with both Roentgenograms and explanatory diagrams.

To anyone whose practice includes endoscopy, this book should prove of real value. T. E. W.

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Telex Hearing Aid (tube). *Jour. A. M. A.*, 114:1634, April 27, 1940.

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Vacolite Vacuum Tube Hearing Aid (tube). *Jour. A. M. A.*, 116:2597, June 7, 1941.

Vacolite Model D Hearing Aid (tube). *Jour. A. M. A.*, 118: 896, March 14, 1942. Mfr.: Vacolite Co., 3003 North Henderson, Dallas.

Western Electric Ortho-tronic Audiphone (tube). *Jour. A. M. A.*, 121:1283, April 17, 1943.

Western Electric Audiphone, Ortho-Technic Model (carbon). *Jour. A. M. A.*, 112:1062, March 18, 1939. Mfr.: Western Electric Co., 300 Central Avenue, Kearny, N. J.

Audiometers Accepted.

Maico Audiometer, Model D-5. *Jour. A. M. A.*, 114:139, Jan. 13, 1940.

Maico Audiometer, Model D-8. *Jour. A. M. A.*, 120:205, Sept. 19, 1942. Mfr.: Maico Co., Inc., 2632-36 Nicollet Avenue, Minneapolis.

Western Electric Audiometer, Model 6B. *Jour. A. M. A.*, 114:1634, April 27, 1940.

Western Electric 4C Audiometer. *Jour. A. M. A.*, 118:1297, April 11, 1942. Mfr.: Western Electric Co., 300 Central Avenue, Kearny, N. J.

DIRECTORY OF NATIONAL OTOLARYNGOLOGIC SOCIETIES.

American Otological Society.

President: Dr. Wesley C. Bowers, 17 E. 61st Street, New York.
Secretary: Dr. Isidore Friesner, 101 E. 73rd Street, New York.

American Laryngological Association.

President: Dr. Charles J. Imperatori, 108 E. 38th Street, New York.
Secretary: Dr. Arthur W. Proetz, Beaumont Building St. Louis.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. H. Marshall Taylor, 111 W. Adams Street, Jacksonville.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Building, Rochester, N. Y.

Sections:

Eastern—Chairman: Dr. Westley M. Hunt, 33 East 68th Street, New York.
Meeting Place: New York, Jan. 14, 1944.

Southern—Chairman: Dr. William C. Warren, Jr., Doctors' Building, Atlanta.
Meeting Place: Atlanta, Jan. 8, 1944.

Middle—Chairman: Dr. Fred W. Dixon, 2060 East 9th Street, Cleveland.
Meeting Place: Cleveland, Jan. 12, 1944.

Western—Chairman: Dr. Simon Jesberg, 500 South Lucas Avenue, Los Angeles.
Meeting Place: Los Angeles, Jan. 22-23, 1944.

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology.

Chairman: Dr. Claude C. Cody, 1304 Walker Ave., Houston.
Secretary: Dr. Louis H. Clerf, 1530 Locust Street, Philadelphia.
Place: San Francisco.

American Academy of Ophthalmology and Otolaryngology.

President: Dr. Ralph I. Lloyd, 14 8th Avenue, Brooklyn.
President-Elect: Dr. James A. Babbitt, 1912 Spruce Street, Philadelphia.

American Broncho-Esophagological Association.

President: Dr. Robert L. Moorhead, 125 Ramsen Street, Brooklyn.
Secretary: Dr. Paul Holinger, 700 N. Michigan Avenue, Chicago.

Los Angeles Society of Ophthalmology and Otolaryngology.

President: Dr. Sylvester H. Welsh, 102 N. Brand Boulevard, Glendale Cal.
Vice-President: Dr. M. E. Trainor, 523 W. 6th, Los Angeles.
Secretary-Treasurer: Dr. Orrie H. Ghrist, 210 N. Central, Glendale, Cal.
Committeeman: Dr. Isaac H. Jones, 635 S. Westlake, Los Angeles.
Place: Los Angeles County Medical Association Building, 1935 Wilshire Boulevard, Los Angeles.
Time: 6:00 P.M., fourth Monday of each month, September to May, incl.